

**EPA Superfund  
Record of Decision:**

**VALLEY WOOD PRESERVING, INC.  
EPA ID: CAD063020143  
OU 01  
TURLOCK, CA  
09/27/1991**

#SLD

## 1.0 SITE LOCATION AND DESCRIPTION

THE VALLEY WOOD PRESERVING (VWP) SUPERFUND SITE, AN INACTIVE WOOD PRESERVING FACILITY, IS LOCATED AT 2237 SOUTH GOLDEN STATE BOULEVARD IN AN UNINCORPORATED AREA OF STANISLAUS COUNTY, CALIFORNIA, ABOUT 1.5 MILES SOUTHEAST OF THE CITY OF TURLOCK'S CORPORATE BOUNDARY (FIGURE 1-1). THE MERCED COUNTY LINE IS ABOUT ONE-HALF MILE SOUTHEAST OF THE SITE. THE SITE IS LOCATED WITHIN SECTION 25 OF TOWNSHIP 5 SOUTH, RANGE 10 EAST, RELATIVE TO THE MOUNT DIABLO BASE AND MERIDIAN.

PROMINENT MAN-MADE LANDMARKS IN THE VICINITY OF THE SITE INCLUDE THE SOUTHERN PACIFIC RAILROAD THAT PARALLELS SOUTH GOLDEN STATE BOULEVARD TO THE EAST; THE REST AREA ON STATE HIGHWAY 99, ABOUT ONE-HALF MILE TO THE SOUTH; TURLOCK IRRIGATION DISTRICT (TID) LATERAL NO. 5 SURFACE DRAIN, ABOUT ONE-HALF MILE TO THE SOUTH; AND JOHNSON SCHOOL, ABOUT ONE MILE TO THE SOUTH IN MERCED COUNTY. THE TURLOCK AIRPARK IS LOCATED ABOUT ONE-AND-ONE-QUARTER MILES TO THE WEST.

THE SITE, OCCUPYING AN AREA OF APPROXIMATELY 14.4 ACRES, IS ESSENTIALLY LEVEL WITH PARTS OF THE SITE GRADED TO CONTROL SURFACE WATER RUNOFF. THE FORMER WOOD TREATING AND STORAGE AREA IS PAVED WITH ASPHALT. THE REMAINDER OF THE SITE IS UNPAVED. THE ENTIRE PERIMETER OF THE SITE IS SECURED WITH A 6-FOOT-HIGH CHAINLINK FENCE.

THE SITE IS BOUNDED BY THE SOUTHBOUND LANES OF SOUTH GOLDEN STATE BOULEVARD TO THE EAST, A VINEYARD TO THE NORTH, A POULTRY FARM TO THE SOUTH, AND FALLOW AGRICULTURAL/RESIDENTIAL LOTS TO THE WEST. LAND USE IN THE VICINITY OF THE SITE IS MOSTLY AGRICULTURAL. MOST OF THE AGRICULTURAL PLOTS NEAR THE SITE ARE RELATIVELY LARGE AND AT LEAST PARTIALLY IN RESIDENTIAL USE.

A SINGLE-FAMILY RESIDENCE IS LOCATED IN THE NORTHEAST CORNER OF THE SITE. ASSOCIATED STRUCTURES INCLUDE A GARAGE/WORKSHOP AND A STORAGE SHED. WATER FOR DOMESTIC USE IS OBTAINED FROM A WELL, DESIGNATED VWP-2, LOCATED IMMEDIATELY NORTHWEST OF THE RESIDENCE. ALSO, SEVERAL CORRUGATED METAL BUILDINGS FORMERLY OCCUPIED BY AN EQUIPMENT RENTAL COMPANY ARE LOCATED NEAR THE SOUTHEAST CORNER OF THE SITE. THEY INCLUDE TWO SERVICE/STORAGE-TYPE BUILDINGS AND A COVERED WORK STRUCTURE. MOST OF THE WOOD PRESERVING FACILITIES AND EQUIPMENT HAVE BEEN DISMANTLED AND REMOVED; HOWEVER, AN EQUIPMENT SHED, TWO LARGE ABOVEGROUND TANKS, A POLE SHED, AND AN OFFICE STRUCTURE REMAIN. A 600,000-GALLON TANK CONSTRUCTED AFTER CLOSURE OF THE WOOD TREATING FACILITY IS ON-SITE AS PART OF THE INTERIM GROUNDWATER CLEANUP PROGRAM.

SUBSURFACE FEATURES AT THE SITE INCLUDE SUBSURFACE TID IRRIGATION DRAINS AND SUBSURFACE PIPING. FOUR UNDERGROUND STORAGE TANKS WERE REMOVED IN 1990. THE SUBSURFACE TID IRRIGATION PIPELINE DRAIN TRANSECTS THE EASTERN PORTION OF THE SITE PARALLEL TO SOUTH GOLDEN STATE BOULEVARD. THE INVERT OF THE PIPE IS 4.5 TO 5.0 FEET BELOW GRADE. THE TID EVENTUALLY DISCHARGES TO THE SAN JOAQUIN RIVER ABOUT 12 MILES WEST OF THE SITE.

THREE WATER PRODUCING WELLS, VWP-1, VWP-2, AND VWP-3, ARE THE OTHER SUBSURFACE FEATURES AT THE SITE. ACCORDING TO SITE PLANS, ONLY VWP-3 (INACTIVE) OF THE THREE WELLS APPEARS TO HAVE HAD A SIGNIFICANT WATER DISTRIBUTION SUBSURFACE PIPING SYSTEM ON-SITE.

THE MEAN ANNUAL PRECIPITATION IN THE SITE AREA IS 11.7 INCHES, 80 PERCENT OF WHICH FALLS AS RAIN BETWEEN NOVEMBER AND MARCH. AVERAGE MONTHLY AIR TEMPERATURE VARIES FROM 45.7 DEGREE FAHRENHEIT IN DECEMBER AND JANUARY TO 76.9 DEGREE FAHRENHEIT IN JULY. MEAN ANNUAL WIND SPEED IS APPROXIMATELY 7 MILES PER HOUR. THE PREVAILING WIND DIRECTION IS NORTH-NORTHWEST TO NORTHWEST, EXCEPT IN DECEMBER, JANUARY, AND FEBRUARY WHEN IT IS TO THE SOUTHEAST.

MOST OF THE DIRECT PRECIPITATION AND RUNOFF FROM PAVED AREAS PERCOLATES RAPIDLY INTO THE GROUND. THERE IS LITTLE, IF ANY, OVERLAND FLOW AND NO SIGNIFICANT STREAMS OR CREEKS EXIST IN THE VICINITY OF THE SITE. THERE IS AN EXTENSIVE NETWORK OF SUBSURFACE DRAINS AND IRRIGATION PIPES ORIGINATING FROM TID LATERAL NO. 5 SURFACE DRAIN LOCATED TO THE SOUTH.

IN THE VICINITY OF THE SITE, 8 TO 14 FEET OF VADOSE ZONE OVERLIE AN UNCONFINED AQUIFER THAT EXTENDS TO A DEPTH OF APPROXIMATELY 140 FEET. THE UNCONFINED AQUIFER IS SEPARATED FROM THE CONFINED AQUIFER BY A LOW PERMEABILITY CLAY LAYER (AQUITARD) CALLED THE "E-CLAY," WHICH IS PRESENT BETWEEN 140 AND 185 FEET BELOW GRADE. THE WATER TABLE IS TYPICALLY 4 TO 8 FEET BELOW

GRADE, BUT IS SEVERAL FEET DEEPER AT THIS TIME DUE TO DROUGHT CONDITIONS. THE GROUNDWATER FLOWS TO THE SOUTHWEST AND HAS AN AVERAGE HYDRAULIC GRADIENT OF APPROXIMATELY 0.002 UNDER NONPUMPING CONDITIONS. THE AVERAGE TRANSMISSIVITY OF THE UNCONFINED AQUIFER IS 1,500 SQUARE FEET PER DAY. THE HYDRAULIC GRADIENT BETWEEN THE UNCONFINED AND CONFINED AQUIFERS IS VERTICALLY DOWNWARD.

THE "E-CLAY" IS CHARACTERIZED BY ITS DARK GREENISH-GRAY TO BLUE-GRAY COLOR, WHICH IS PROBABLY DUE TO THE REDUCED STATE OF THE FERROUS IRON CONTAINED IN THE CLAY MINERALS. THE MOST DIAGNOSTIC FEATURE OF THE "E-CLAY" IS THE PRESENCE OF DIATOMS, WHICH TEND TO BE CONCENTRATED NEAR THE STRATIGRAPHIC MIDDLE OF THE UNIT. THE OLDER ALLUVIUM OVERLIES THE "E-CLAY" AND CONSISTS OF INTERCALATED BEDS OF GRAVEL, SAND, SILT, AND CLAY WITH SOME "HARDPAN." COLORATION OF THE OLDER ALLUVIUM IS VARIABLE AND HAS BEEN REPORTED AS BROWN, REDDISH-BROWN, GRAY, BROWNISH-GRAY, WHITE, BLUE, AND BLACK. IT IS GENERALLY DISTINGUISHED FROM THE UNDERLYING CONTINENTAL DEPOSITS BY ITS COARSER-GRAINED TEXTURE. THE OLDER ALLUVIUM REPORTEDLY BECOMES LESS PERMEABLE WITH DEPTH.

THE UNCONFINED AQUIFER ZONE HAS BEEN EXTENSIVELY DEVELOPED AS A GROUNDWATER RESOURCE. THERE ARE 105 CURRENT OR FORMER WATER-PRODUCING WELLS WITHIN THE STUDY AREA, IN ADDITION TO THE 56 MONITORING WELLS INSTALLED DURING INVESTIGATIONS AT THE VWP SITE. NINETY-ONE OF THESE WELLS (81 ACTIVE AND 10 INACTIVE) ARE FOR DOMESTIC WATER SUPPLY, SIX ARE "DRAINAGE" WELLS, SIX ARE "INDUSTRIAL-USE" WELLS, AND TWO ARE WITHOUT ANY KNOWN USE. THE EXTRACTION OF SMALL QUANTITIES OF GROUNDWATER FROM THE DOMESTIC WELLS IN THE STUDY AREA DOES NOT HAVE A SIGNIFICANT EFFECT ON THE REGIONAL GROUNDWATER FLOW REGIME. HOWEVER, RELATIVELY LARGE VOLUMES OF WATER ARE EXTRACTED FROM THE UNCONFINED AQUIFER ON A CONTINUOUS BASIS BY TID TO CONTROL GROUNDWATER LEVELS.

## **#SHEA**

### **2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES**

WOOD PRESERVING OPERATIONS AT VWP WERE CONDUCTED FROM 1973 THROUGH 1979 AND RESULTED IN ON-SITE AND OFF-SITE SOIL AND GROUNDWATER CONTAMINATION. THE CONTAMINANTS OF CONCERN AT VWP INCLUDE HEXAVALENT CHROMIUM AND ARSENIC IN THE SOILS, FROM SURFACE TO APPROXIMATELY 12 FEET IN DEPTH, AND HEXAVALENT CHROMIUM AND ARSENIC IN THE GROUNDWATER. THE GROUNDWATER CONTAMINANT PLUME EXTENDS APPROXIMATELY 2,000 FEET OFFSITE TO THE SOUTHWEST AND POSES A SUBSTANTIAL THREAT TO NEIGHBORING DOMESTIC WELLS.

VWP PRESERVED LUMBER USING AN AQUEOUS SOLUTION CONTAINING 1 TO 2 PERCENT CHROMATED-COPPER-ARSENATE (CCA). THE WOOD PRESERVING CHEMICALS WERE STORED AND MIXED ON-SITE IN THREE ABOVE-GROUND STORAGE TANKS. LUMBER IN LOADS OF UP TO 20,000 POUNDS WAS PLACED ONTO A RAIL-MOUNTED TREATMENT TRAIN AND PUSHED INTO ONE OF FOUR PRESSURE TREATMENT CYLINDERS. AFTER TREATMENT, THE TRAIN WOULD EXIT THE CYLINDER AND THE WOOD WOULD BE UNLOADED AND ALLOWED TO DRIP DRY ON PAVED AND UNPAVED AREAS. CHEMICAL SPILLS, LEAKING TANKS, ON-SITE DISPOSAL PRACTICES, AND CHEMICAL DRIPPINGS FROM TREATED LUMBER ARE THE KNOWN SOURCES OF CONTAMINATION ASSOCIATED WITH THE VWP SITE. (SITE FEATURES ARE SHOWN ON FIGURE 2-1.)

HAROLD AND JOYCE LOGSDON WERE THE OWNERS OF THE VWP SITE FROM THE BEGINNING OF OPERATIONS AT THE SITE UNTIL 1980 WHEN VALLEY WOOD PRESERVING, INC. ACQUIRED FULL OWNERSHIP OF VWP. HAROLD AND JOYCE LOGSDON AT ALL TIMES HAVE OWNED BETWEEN 25 AND 50 PERCENT OF THE STOCK OF VALLEY WOOD PRESERVING (VWP), INC. HOWEVER, THEY ARE NOT THE SOLE STOCKHOLDERS OF THE CORPORATION; FIVE OTHER INDIVIDUALS HAVE BEEN IDENTIFIED AS STOCKHOLDERS BY THE CALIFORNIA ATTORNEY GENERAL'S OFFICE.

### **2.1 INITIAL INVESTIGATIONS**

IN 1979, THE CALIFORNIA CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD (CVRWQCB) IDENTIFIED TOXIC WOOD TREATING CHEMICALS (CHROMIUM, ARSENIC, COPPER) WITHIN AN ON-SITE STORAGE POND, WITHIN HOLDING TANKS, AND IN ON-SITE AND OFF-SITE SOILS. IN ADDITION, GROUNDWATER CONTAMINATED WITH THESE SAME CHEMICALS WAS DETECTED WITHIN THE SHALLOW, UNCONFINED AQUIFER AT THE SITE. IN NOVEMBER 1979, THE CVRWQCB ISSUED A CLEANUP AND ABATEMENT ORDER TO VWP, INC. IN 1980, THE CVRWQCB OBTAINED A PRELIMINARY INJUNCTION ORDERING VWP, INC. TO UNDERTAKE GROUNDWATER PUMP-AND-TREAT ACTIONS AT THE SITE. VWP, INC. BEGAN SOIL AND GROUNDWATER SAMPLING IN EARLY 1980, BUT CEASED REMEDIAL EFFORTS IN 1983 DUE TO ALLEGED FINANCIAL DIFFICULTIES.

IN MARCH 1987, THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES (DHS), NOW KNOWN AS THE CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL (DTSC), ISSUED A REMEDIAL ACTION ORDER (RAO) TO VWP, INC.

REQUIRING IT TO CONDUCT A REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) AND TO DEVELOP A REMEDIAL ACTION PLAN (RAP). IN RESPONSE TO THE RAO, VWP, INC. CONTRACTED WITH GEOSYSTEM CONSULTANTS, INC. TO CONDUCT AN RI/FS AT THE SITE. IN JANUARY 1989, VWP, INC. SUBMITTED TO DHS THE INITIAL DRAFT RI REPORT THAT HAS BEEN REVISED SEVERAL TIMES TO REFLECT ADDITIONAL SITE CHARACTERIZATION. VWP WAS PROPOSED FOR INCLUSION ON THE NATIONAL PRIORITIES LIST (NPL) IN JUNE 1988 AND ADDED TO THE NPL IN MARCH 1989. THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) BECAME THE LEAD AGENCY IN SEPTEMBER 1989.

## **2.2 REMOVAL ACTIONS**

WHILE THE RI WAS BEING REVISED, EPA BECAME CONCERNED ABOUT THE THREATS TO WATER QUALITY IN THE NEIGHBORING RESIDENTIAL WELLS. IN AUGUST 1989, EPA ADVISED VWP, INC. TO CONDUCT MONTHLY DOMESTIC WELL SAMPLING. IN ADDITION, EPA BEGAN PREPARING A REMOVAL CONSENT ORDER TO REQUIRE VWP, INC. TO IMPLEMENT AN INTERIM PUMP-AND-TREAT OPERATION TO CONTAIN THE OFF-SITE MIGRATION OF THE GROUNDWATER PLUME. FROM SEPTEMBER THROUGH NOVEMBER 1989, EPA CONDUCTED SITE AND NEIGHBORHOOD VISITS WITH RESIDENTS IN THE AREA. IN OCTOBER 1989, SEVERAL DOMESTIC WELLS SHOWED DETECTABLE CONCENTRATIONS OF HEXAVALENT CHROMIUM. IN NOVEMBER 1989, EPA'S ENVIRONMENTAL SERVICES BRANCH SAMPLED SEVEN DOMESTIC WELLS, AND THE DATA REVEALED THAT SEVERAL OF THE WELLS CONTAINED ELEVATED CONCENTRATIONS OF HEXAVALENT CHROMIUM; THESE LEVELS WERE, HOWEVER, BELOW THE CALIFORNIA MAXIMUM CONTAMINANT LEVEL (MCL) FOR CHROMIUM.

THE REMOVAL CONSENT ORDER WAS SIGNED ON DECEMBER 8, 1989. THE ORDER CALLS FOR VWP, INC. TO CONDUCT TWO AQUIFER TESTS TO DETERMINE THE AQUIFER'S HYDROLOGIC CHARACTERISTICS AND TO AID IN THE DESIGN AND IMPLEMENTATION OF AN EXTRACTION SYSTEM FOR THE INTERIM PUMPING.

FOLLOWING COMPLETION OF THE AQUIFER TESTS, VWP, INC. IS REQUIRED TO IMPLEMENT AN INTERIM PUMP-AND-TREAT SYSTEM. IN ADDITION, THE REMOVAL CONSENT ORDER CALLS FOR VWP, INC. TO DESIGN A PLAN FOR THE DEVELOPMENT OF AN ALTERNATIVE WATER SUPPLY FOR AFFECTED RESIDENTS. AN ALTERNATE WATER SUPPLY MUST BE MADE AVAILABLE TO AFFECTED RESIDENTS IF ANY CONTAMINANT IN EXISTING SUPPLY WELLS REACHES 60 PERCENT OF ITS MCL. TO DATE, VWP, INC. HAS GENERALLY COMPLIED WITH THE REMOVAL CONSENT ORDER. THE EXTRACTION AND ELECTROCHEMICAL TREATMENT SYSTEM HAS BEEN OPERATING SINCE JUNE 1990.

IN JANUARY 1990, VWP, INC. BEGAN TO INSTALL THREE DEEP GROUNDWATER WELLS TO SERVE AS DOMESTIC WATER SUPPLIES. THESE WELLS HAVE BEEN COMPLETED AND DETERMINED TO BE CLEAN AND RESIDENTIAL WATER IS NOW SUPPLIED BY THESE WELLS. VWP, INC. WILL EVENTUALLY SEAL THE OLD, SHALLOW DOMESTIC WELLS; THEY ARE CURRENTLY USED AS MONITORING WELLS.

## **2.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

ON MAY 4, 1990, HAROLD LOGSDON SIGNED A SECOND EPA ADMINISTRATIVE CONSENT ORDER ON BEHALF OF RESPONDENT VWP, INC. THE ADMINISTRATIVE CONSENT ORDER REQUIRES VWP, INC. TO CONDUCT AN RI/FS. THE EFFECTIVE DATE OF THIS ORDER, WHICH SUPERSEDES THE 1987 DHS RAO, IS MAY 1, 1990. AS PART OF THE RI/FS, EPA COMPLETED A BASELINE RISK ASSESSMENT IN FEBRUARY 1991 TO ESTIMATE POTENTIAL HEALTH AND ENVIRONMENTAL RISKS THAT COULD RESULT IF NO ACTION WERE TAKEN AT THE SITE. THE RISK ASSESSMENT INDICATED THAT EXPOSURE TO GROUNDWATER CONTAMINATED BY CHEMICALS FROM VWP COULD RESULT IN SIGNIFICANT HEALTH RISKS. NO SIGNIFICANT ECOLOGICAL RISKS WERE IDENTIFIED. THE RISK ASSESSMENT IS DESCRIBED IN MORE DETAIL IN SECTION 6.0.

IN JUNE 1991, THE RI/FS WAS COMPLETED WITH THE FOLLOWING CONCLUSIONS:

- THE CONTAMINANTS OF CONCERN IN BOTH SOIL AND GROUNDWATER ARE HEXAVALENT CHROMIUM AND ARSENIC.
  - THE GROUNDWATER PLUME CONTINUES TO MIGRATE TOWARD DOMESTIC WELLS.
  - ADDITIONAL INVESTIGATION OF THE VERTICAL EXTENT OF THE GROUNDWATER PLUME IS REQUIRED IMMEDIATELY TO ENSURE SUCCESSFUL DESIGN AND IMPLEMENTATION OF THE EXTRACTION WELL FIELD.
  - REMEDIAL TECHNOLOGIES CAPABLE OF CLEANING UP THE VWP SITE IN ACCORDANCE WITH EPA AND STATE STANDARDS ARE AVAILABLE.

## **#HCI**

### **3.0 HIGHLIGHTS OF COMMUNITY INVOLVEMENT**

COMMUNITY INTEREST IN THE VWP SITE WAS HIGH DURING THE LATE 1970S WHEN OWNERS OF PROPERTY ADJACENT TO THE SITE BECAME CONCERNED ABOUT ODORS, POTENTIALLY CONTAMINATED DOMESTIC WELLS, AND GENERAL EXPOSURES TO SITE CHEMICALS. INTEREST HAS SUBSIDED SOMEWHAT SINCE THE ONSET OF REMEDIAL ACTIVITIES, WHICH CONTINUE TO BE FREQUENTLY COVERED BY LOCAL NEWSPAPERS.

EPA HAS ENCOURAGED PUBLIC PARTICIPATION DURING THE RI/FS PROCESS AND HAS MET THE REQUIREMENTS FOR PUBLIC PARTICIPATION UNDER CERCLA SECTION 113(K)(2)(B)(I-V). PUBLIC PARTICIPATION HAS OCCURRED THROUGH THE FOLLOWING ACTIVITIES:

NOVEMBER 1988	RELEASE OF THE COMMUNITY RELATIONS PLAN (CRP) UNDER THE DIRECTION OF DHS (NOW DTSC)
JANUARY 1989	DHS FACT SHEET REGARDING SITE INVESTIGATIONS
OCTOBER 1989	EPA COMMUNITY INTERVIEWS, FACT SHEET REGARDING EPA INVOLVEMENT AT VWP
DECEMBER 1989	EPA PROGRESS LETTER
APRIL 1990	EPA FACT SHEET ON THE REMOVAL PUMP-AND-TREAT SYSTEM
JUNE 1990	EPA FACT SHEET ON GROUNDWATER CLEANUP ACTIVITIES
JANUARY 1991	EPA FACT SHEET ON REMEDIAL INVESTIGATION ACTIVITIES
JUNE 1991	PUBLIC NOTICE AND RELEASE OF DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND PROPOSED PLAN FOR PUBLIC COMMENT
JUNE 1991	EPA LETTER REMINDING COMMUNITY OF PROPOSED PLAN PUBLIC MEETING
JUNE 1991	A FORMAL PUBLIC MEETING IN ACCORDANCE WITH CERCLA SECTION 117(A)(2) WAS HELD ON JUNE 25 TO DISCUSS THE RI/FS AND THE PROPOSED PLAN. APPROXIMATELY 25 COMMUNITY MEMBERS ATTENDED AND NO PUBLIC OPPOSITION TO THE PLAN WAS VOICED. TWO WRITTEN COMMENTS WERE SUBMITTED AT THE MEETING; THE STATE AND PRPS WERE THE ONLY OTHER COMMENTORS DURING THE PUBLIC COMMENT PERIOD.

THE ADMINISTRATIVE RECORD FILE HAS BEEN ESTABLISHED AT EPA'S REGION 9 OFFICE IN SAN FRANCISCO AND AT THE CITY OF TURLOCK LIBRARY. RESPONSES TO OFFICIAL PUBLIC COMMENT ARE PRESENTED IN THE RESPONSE SUMMARY ATTACHED AS APPENDIX A TO THIS ROD.

## **#SRRA**

### **4.0 SCOPE AND ROLE OF RESPONSE ACTIONS**

THE SELECTED RESPONSE ACTIONS ADDRESS CONTAMINATION IN SOIL AND GROUNDWATER CAUSED BY OPERATIONS AT THE VWP SITE. THE RESPONSE ACTIONS WILL BE PERFORMED TO MEET THE FINAL SITE TREATMENT STANDARDS LISTED IN TABLE 4-1. THESE LEVELS ARE BASED ON APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND HEALTH PROTECTION CRITERIA. TABLE 4-2 PRESENTS REGULATORY STANDARDS AND GUIDELINES FOR ARSENIC AND HEXAVALENT (CHROMIUM VI) CHROMIUM.

ARSENIC, COPPER, HEXAVALENT CHROMIUM, AND TRIVALENT CHROMIUM ARE CONTAMINANTS FREQUENTLY DETECTED IN ELEVATED CONCENTRATIONS AT THE SITE. EPA'S RISK ASSESSMENT DETERMINED THAT HEALTH RISKS FROM TRIVALENT CHROMIUM AND COPPER AT THE SITE ARE NOT SIGNIFICANT; THEREFORE, ARSENIC AND HEXAVALENT CHROMIUM ARE THE PRIMARY CONTAMINANTS OF CONCERN. IN SIGNIFICANT CONCENTRATIONS, ARSENIC IN ALL MEDIA AND HEXAVALENT CHROMIUM IN INHALED PARTICULATES ARE KNOWN HUMAN CARCINOGENS. THEY ARE PRESENT AT THE VWP SITE AT CONCENTRATIONS EXCEEDING HEALTH STANDARDS. THE SELECTED REMEDIES PRESENTED HEREIN ADDRESS THE DOCUMENTED POTENTIAL THREATS FROM THE SITE. TREATMENT OF THE CONTAMINATED SOIL AND GROUNDWATER WILL SIGNIFICANTLY REDUCE THE POTENTIAL FOR FUTURE EXPOSURE TO CONTAMINATED SOIL AND GROUNDWATER.

#### **4.1 SOIL CONTAMINATION**

THE SURFACE SOIL (0 TO 4 FEET IN DEPTH) CLEANUP STANDARDS FOR THE SITE ARE BASED ON POTENTIAL HEALTH RISKS FROM INHALATION AND DIRECT CONTACT, CORRESPONDING TO 1 X (10<sup>-6</sup>) EXCESS CANCER RISK. THEY ARE 4 PPM FOR HEXAVALENT CHROMIUM AND 2 PPM FOR ARSENIC. THE SURFACE SOILS ABOVE THESE CONCENTRATIONS WILL BE REMOVED AND TREATED, THUS REDUCING EXCESS CANCER RISK TO THE 1 X (10<sup>-6</sup>) LEVEL.

THE SUBSURFACE SOIL (DEEPER THAN 4 FEET) CLEANUP STANDARDS FOR THE SITE ARE BASED ON PROTECTION OF GROUNDWATER FROM CONTAMINATED LEACHATE FROM THESE SOILS. THE CLEANUP STANDARDS ARE 5 PPB FOR CHROMIUM AND 5 PPB FOR ARSENIC AS MEASURED IN THE LEACHATE FROM SUBSURFACE SOILS. THESE LEVELS ARE BASED ON THE DESIGNATED LEVEL METHODOLOGY FOR CHARACTERIZING WASTES IN SOILS ADOPTED BY THE CVRWQCB IN JUNE 1989. SUBSURFACE SOILS (BELOW 4 FEET TO THE TOP OF THE WATER TABLE) WITH LEACHATE EXCEEDING THESE LEVELS WILL BE REMOVED AND TREATED.

#### **4.2 GROUNDWATER CONTAMINATION**

THE CLEANUP STANDARD FOR HEXAVALENT CHROMIUM IN GROUNDWATER FOR THE SITE IS 50 PPB, WHICH CORRESPONDS TO THE CALIFORNIA MCL FOR TOTAL CHROMIUM IN DRINKING WATER. THE CORRESPONDING EPA MCL FOR TOTAL CHROMIUM IS 100 PPB. THE 50 PPB CLEANUP STANDARD FOR CHROMIUM WILL REDUCE THE CORRESPONDING HAZARD INDEX TO LESS THAN ONE.

THE CLEANUP STANDARD FOR ARSENIC IN GROUNDWATER FOR THE SITE IS 16 PPB, WHICH IS BASED ON POTENTIAL HEALTH RISK. SINCE THERE ARE TWO CONTAMINANTS, ARSENIC AND HEXAVALENT CHROMIUM, THAT AFFECT THE SAME LOCATION IN THE HUMAN BODY, THE ARSENIC CLEANUP STANDARD IS SET AT 16 PPB SO THAT THE SUM OF THE HAZARD INDEX FOR ALL THE CONTAMINANTS DOES NOT EXCEED ONE.

#### **4.3 PRINCIPAL THREAT**

CONTAMINATED GROUNDWATER AT THE SITE REPRESENTS THE PRIMARY RISK AT THE SITE, AND THE REMEDY WILL SEEK TO RETURN GROUNDWATER TO ITS BENEFICIAL USES WITHIN A REASONABLE PERIOD OF TIME. SOIL CONTAMINATION AT THE SITE REPRESENTS A CONTINUING SOURCE OF GROUNDWATER CONTAMINATION AND REPRESENTS THE PRINCIPAL THREAT AT THE SITE. THIS PRINCIPAL THREAT WILL BE ADDRESSED BY THE REMEDY.

#SSC

#### **5.0 SUMMARY OF SITE CHARACTERISTICS**

THE CONTAMINANTS PRESENT AT AND ADJACENT TO THE VWP SITE APPEAR TO BE RELATED EXCLUSIVELY TO THE CHROMATE-COPPER-ARSENATE SOLUTION USED IN THE WOOD PRESERVING PROCESS AND INCLUDE TRIVALENT CHROMIUM, HEXAVALENT CHROMIUM, COPPER, AND ARSENIC. HEXAVALENT CHROMIUM AND ARSENIC ARE KNOWN HUMAN CARCINOGENS AND ARE CONSIDERED TO BE PRIMARY CONTAMINANTS OF CONCERN AND PRINCIPAL HEALTH THREATS. TRIVALENT CHROMIUM AND COPPER ARE LESS TOXIC THAN THE PRIMARY SITE CONTAMINANTS, ARE IDENTIFIED AS CONTAMINANTS OF LESS CONCERN, AND ARE CONSIDERED LOW-LEVEL THREATS FOR WHICH NO ACTION IS REQUIRED.

#### **5.1 GROUNDWATER**

THE PREDOMINANT METAL DETECTED IN THE UNCONFINED AQUIFER IS HEXAVALENT CHROMIUM. HEXAVALENT CHROMIUM IS PRESENT IN GROUNDWATER FROM THE WESTERN SITE BOUNDARY TO APPROXIMATELY 2,000 FEET DOWNGRAIENT TO THE SOUTHWEST (FIGURE 5-1). THE CONCENTRATIONS OF TOTAL CHROMIUM AND HEXAVALENT CHROMIUM IN THE WELLS SAMPLED ARE GENERALLY EQUAL, INDICATING THERE IS VERY LITTLE TRIVALENT CHROMIUM IN THE GROUNDWATER. UNDER NONPUMPING CONDITIONS THE HEXAVALENT CHROMIUM PLUME APPEARS TO BE MIGRATING AT A RATE OF APPROXIMATELY 0.21 FEET PER DAY; HOWEVER, THE CENTER OF THE PLUME HAS NOT MIGRATED SIGNIFICANTLY SINCE 1986. THE MOVEMENT OF THIS PLUME HAS DECREASED SINCE THE INTERIM PUMPING AND TREATING SYSTEM BEGAN OPERATING IN JUNE 1990.

CURRENTLY, THE 50-PPB HEXAVALENT CHROMIUM ISOCONCENTRATION HAS MIGRATED TO WITHIN ABOUT 200 FEET OF SEVERAL DOMESTIC WELLS ALONG GOLF ROAD. AS OF APRIL 1991, HEXAVALENT CHROMIUM HAD NOT SIGNIFICANTLY AFFECTED ANY OF THESE WATER-PRODUCING WELLS, WHICH SUPPLY THE RESIDENCES ALONG GOLF ROAD. HOWEVER, SHALLOW DOMESTIC WELLS, SEGARS-3, SEGARS-5, AND DIXON-1, HAVE BEEN REPLACED BY DEEPER WATER SUPPLY WELLS AS A PRECAUTION AGAINST FUTURE CONTAMINATION AND PUBLIC EXPOSURE.

THE CONCENTRATIONS OF HEXAVALENT CHROMIUM IN ON-SITE WELLS HAVE DECREASED WITH TIME. CURRENTLY, THE HIGHEST CONCENTRATIONS (UP TO 28,000 PPB) OF HEXAVALENT CHROMIUM HAVE BEEN DETECTED IN WELLS

GW-5, GW-15B, AND GW-26. ALL OF THESE WELLS ARE OFF-SITE TO THE SOUTHWEST OF THE FORMER MIXING TANK AREA. HEXAVALENT CHROMIUM CONCENTRATIONS IN GROUNDWATER DO NOT VARY SIGNIFICANTLY WITH DEPTH IN THE UNCONFINED AQUIFER DOWN TO 60 FEET, ALTHOUGH THE HIGHEST CONCENTRATIONS IN SOME WELL CLUSTERS ARE AT THE DEEPEST INTERVALS (50 TO 60 FT).

TRIVALENT CHROMIUM AND COPPER ARE NOT PRESENT AT CONCENTRATIONS OF CONCERN IN GROUNDWATER, BASED ON ASSESSMENT OF SITE RISKS, AS EXPLAINED IN SECTION 6.0.

ARSENIC HAS BEEN DETECTED IN ON-SITE GROUNDWATER ALONG THE WESTERN SITE BOUNDARY (FIGURE 5-1) UP TO A MAXIMUM CONCENTRATION OF 2,350 PPB. THERE IS NO SIGNIFICANT OFF-SITE MIGRATION OF ARSENIC FROM THE SITE, AS THE ARSENIC PLUME EXTENDS ONLY ABOUT 200 FEET WEST OF THE VWP PROPERTY. THE ARSENIC CONCENTRATIONS IN GROUNDWATER IN AREAS BEYOND THE ARSENIC PLUME SHOWN ON FIGURE 5-1 ARE, IN GENERAL, LESS THAN 20 PPB (NEAR BACKGROUND LEVELS). ALSO, ARSENIC CONCENTRATIONS IN SAMPLES COLLECTED FROM ON-SITE AND OFF-SITE DOMESTIC WELLS ARE WITHIN THE BACKGROUND ARSENIC CONCENTRATION RANGE.

INVESTIGATIONS HAVE NOT BEEN PERFORMED IN THE STUDY AREA TO CHARACTERIZE THE GROUNDWATER IN THE UNCONFINED AQUIFER BELOW 60 FEET AND IN THE STRATA BELOW IT. SINCE THE HYDRAULIC GRADIENT BETWEEN THE TWO AQUIFERS (UNCONFINED AND CONFINED) IS VERTICALLY DOWNWARD, THERE IS CONCERN OVER THE POTENTIAL FOR THE VERTICAL MIGRATION OF HEXAVALENT CHROMIUM FROM THE UNCONFINED AQUIFER TO THE UNDERLYING ZONES. ADDITIONAL INVESTIGATIONS ARE UNDERWAY TO ASSESS THE WATER QUALITY OF THE DEEPER AREAS OF THE UNCONFINED AQUIFER AND OF THE E-CLAY LAYER. THE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM WILL BE EXPANDED TO ADDRESS THE LOWER WATER-BEARING ZONES IF CONTAMINATION IS DETECTED ABOVE CLEANUP LEVELS.

## 5.2 SOIL

THE PRINCIPAL CONTAMINANTS DETECTED IN THE SURFACE SOIL (0 TO 4 FEET) ARE HEXAVALENT CHROMIUM AND ARSENIC. THE APPROXIMATE AREAL EXTENT OF THE SURFACE SOIL AFFECTED BY THESE CONTAMINANTS IS SHOWN ON FIGURE 5-2. HEXAVALENT CHROMIUM IS DISTRIBUTED FAR LESS WIDELY THAN TOTAL CHROMIUM AND IS GENERALLY PRESENT AT SUBSTANTIALLY LOWER CONCENTRATIONS. THUS, MOST OF THE CHROMIUM DETECTED IN SOIL IS IN THE TRIVALENT FORM.

THE MAXIMUM HEXAVALENT CHROMIUM CONTAMINATION DETECTED IN THE SURFACE SOIL IS 30 PPM AT A DEPTH OF 0.5 FEET IN BORING B-7, LOCATED NEAR THE EASTERN EDGE OF THE NORTHERN PAVED DEPRESSION. BACKGROUND CONCENTRATIONS OF HEXAVALENT CHROMIUM ARE LESS THAN 1 PPM. THE ON-SITE SHALLOW SOILS SIGNIFICANTLY AFFECTED BY HEXAVALENT CHROMIUM ARE LIMITED TO THE AREA WEST OF THE TANKS AND TO THE PAVED DEPRESSION AREAS. SOILS IN OFF-SITE AREAS HAVE NOT BEEN SIGNIFICANTLY CONTAMINATED WITH HEXAVALENT CHROMIUM.

ARSENIC CONCENTRATIONS ABOVE THE BACKGROUND LEVELS OF 0.5 - 3 PPM WERE DETECTED IN SURFACE SOIL (0 TO 4 FEET) SAMPLES PRIMARILY IN ON-SITE AREAS, WITH THE EXCEPTION OF BORINGS P-1 THROUGH P-7 LOCATED AROUND THE PERIMETER OF THE PAVED WOOD TREATMENT AND STORAGE AREA AND B-55 LOCATED JUST NORTH OF THE SITE BOUNDARY. THE AREAL DISTRIBUTION OF ARSENIC IN SURFACE SOIL SAMPLES IS SHOWN ON FIGURE 5-2. AS SHOWN ON THIS FIGURE, SURFACE SOILS CONTAMINATED WITH ARSENIC ARE LOCALIZED PRIMARILY AROUND THE FORMER MIXING TANKS AND NORTHEAST OF THE SITE. THE MAXIMUM ARSENIC CONCENTRATION DETECTED IN SURFACE SOILS IS 140 PPM AT A DEPTH OF 0.7 FEET IN BORING P-2, LOCATED IN THE NORTHERN PART OF THE ON-SITE AREA AT THE EDGE OF THE PAVED WOOD-TREATMENT AND STORAGE AREA.

THE DISTRIBUTION OF HEXAVALENT CHROMIUM IN SUBSURFACE SOILS (4 FEET TO WATER TABLE) WAS VERY SIMILAR TO THAT IN SURFACE SOILS (FIGURE 5-3). SAMPLING RESULTS INDICATE LITTLE VERTICAL VARIATION IN HEXAVALENT CHROMIUM CONCENTRATIONS IN SOIL. THE MAXIMUM DETECTED CONCENTRATION OF HEXAVALENT CHROMIUM IN SUBSURFACE SOIL WAS 68 PPM AT A DEPTH OF 6.5 FEET IN BORING S-8, LOCATED WEST OF THE FORMER MIXING TANKS.

ELEVATED ARSENIC CONCENTRATIONS IN SUBSURFACE SOILS OCCUR ONLY IN THE VICINITY OF THE WOOD PRESERVING AREAS NEAR THE WESTERN ON-SITE BOUNDARY, AS SHOWN ON FIGURE 5-3. THE MAXIMUM ARSENIC CONCENTRATION DETECTED WAS 232 PPM AT A DEPTH OF 6.5 FEET IN BORING B-19 LOCATED IN THIS AREA.

COPPER WAS DETECTED ABOVE BACKGROUND CONCENTRATIONS OF 7 PPM IN SUBSURFACE SOILS IN THE SAME AREA REPORTED FOR HEXAVALENT CHROMIUM AND IN SOILS AROUND THE PERIMETER OF THE PAVED AREA ON-SITE. THE MAXIMUM COPPER CONCENTRATION DETECTED WAS 845 PPM AT A DEPTH OF 6.5 FEET IN BORING

B-19, LOCATED BETWEEN THE FORMER LOCATIONS OF THE TWO SOUTHERN RETORTS.

### 5.3 CONCLUSION

CHROMIUM AND ARSENIC CONCENTRATIONS EXCEEDING FEDERAL AND STATE DRINKING WATER STANDARDS OCCUR IN THE CONTAMINATED AREA OF THE UNCONFINED AQUIFER DOWN TO AT LEAST 60 FEET BELOW THE SURFACE AND EXTEND TO APPROXIMATELY 2,000 FEET DOWNGRAIENT OF THE VWP BOUNDARY. THE GROUNDWATER CLEANUP STANDARD FOR CHROMIUM CORRESPONDS TO THE CALIFORNIA MCL OF 50 PPB. THE CLEANUP STANDARD OF 16 PPB FOR ARSENIC CORRESPONDS TO A HAZARD INDEX OF 1. THESE ARE CONCENTRATIONS AT WHICH NO ADVERSE HEALTH EFFECTS ARE EXPECTED TO OCCUR THROUGH ANY EXPOSURE PATHWAY. EPA EXPECTS THAT APPROXIMATELY 360,000 GALLONS OF CONTAMINATED GROUNDWATER WILL REQUIRE TREATMENT EACH DAY FOR AT LEAST 5 YEARS.

THE MOST SERIOUSLY CONTAMINATED SOILS ARE UNDER THE PAVED AREA ON THE VWP PROPERTY. THE AREA WITH THE HIGHEST LEVELS OF SOIL CONTAMINATION CONSISTS OF NEARLY ONE-EIGHTH ACRE, LOCATED ON THE WEST SIDE OF THE 600,000-GALLON TANK CURRENTLY BEING USED IN THE INTERIM GROUNDWATER CLEANUP PROGRAM. ANOTHER AREA UNDER THE NORTHEAST CORNER OF THE PAVEMENT IS ALSO SIGNIFICANTLY CONTAMINATED WITH HEXAVALENT CHROMIUM AND ARSENIC. EPA'S REMEDY FOR SOIL CLEANUP WILL INVOLVE EXCAVATION AND TREATMENT OF APPROXIMATELY 15,000 CUBIC YARDS OF SOIL CONTAMINATED WITH ARSENIC AND HEXAVALENT CHROMIUM. THE REMEDY WILL REDUCE THESE SOIL CONTAMINANT CONCENTRATIONS TO THOSE CORRESPONDING TO POTENTIAL EXCESS HEALTH RISK OF  $1 \times (10^{-6})$ .

THE PRINCIPAL SITE-RELATED CHEMICALS, THE MEDIA AFFECTED, BACKGROUND CONCENTRATION LEVELS, AND MAXIMUM CONCENTRATION LEVELS DETECTED ARE PRESENTED IN TABLE 4-1. DATA USED BY EPA TO DEVELOP THE FEASIBILITY STUDY, TO SELECT REMEDIAL ALTERNATIVES, AND TO DEVELOP CONCLUSIONS AND CLEANUP STANDARDS PRESENTED IN THIS RECORD OF DECISION (ROD) WERE VALIDATED BY EPA AND CONSIDERED OF ACCEPTABLE QUALITY FOR THE PURPOSES OF THE RI/FS.

### #SSR

### 6.0 SUMMARY OF SITE RISKS

EPA PREPARED AN ENDANGERMENT ASSESSMENT TO DOCUMENT THE POTENTIAL RISKS ASSOCIATED WITH THE ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THE VWP SITE. THIS SECTION SUMMARIZES THE INFORMATION FOUND IN THE FOLLOWING TWO DOCUMENTS:

(1) US ENVIRONMENTAL PROTECTION AGENCY, FEBRUARY 4, 1991. RISK ASSESSMENT, VALLEY WOOD PRESERVING SITE, TURLOCK, CALIFORNIA. EPA WA C09030 (PREPARED BY PRC ENVIRONMENTAL MANAGEMENT, INC.).

(2) US ENVIRONMENTAL PROTECTION AGENCY, NOVEMBER 21, 1990. PRELIMINARY ECOLOGICAL RISK ASSESSMENT, VALLEY WOOD PRESERVING SITE, TURLOCK, CALIFORNIA. EPA WA C09030 (PREPARED BY VERSAR, INC.).

### 6.1 HEALTH RISKS

VWP USED A SOLUTION OF CHROMATE-COPPER-ARSENATE (CCA) IN DAY-TO-DAY OPERATIONS. THESE WERE ALSO THE COMPOUNDS DETECTED MOST FREQUENTLY AND AT THE GREATEST CONCENTRATIONS IN ON-SITE AND/OR OFF-SITE SOILS AND GROUNDWATER. OF THESE, HEXAVALENT CHROMIUM IN GROUNDWATER WAS THE ONLY CONTAMINANT LINKED TO THE SITE THAT WAS IDENTIFIED AS A CONTAMINANT OF CONCERN UNDER CURRENT LAND USE CONDITIONS. CONTAMINANTS OF CONCERN UNDER FUTURE LAND USE CONDITIONS INCLUDE HEXAVALENT CHROMIUM AND ARSENIC. COPPER WAS NOT CHOSEN AS A CHEMICAL OF CONCERN PRIMARILY BECAUSE OF ITS LOW MOBILITY AND LOW HUMAN TOXICITY. ARSENIC AND HEXAVALENT CHROMIUM WERE SELECTED BECAUSE OF THEIR RELATIVELY HIGH HUMAN TOXICITY, THE SIGNIFICANT CONCENTRATIONS DETECTED, AND DETECTION FREQUENCY IN SOIL AND GROUNDWATER.

HEXAVALENT CHROMIUM WAS IDENTIFIED IN THE TOXICITY ASSESSMENT AS A PROBABLE HUMAN CARCINOGEN ONLY VIA INHALATION, WHEREAS ARSENIC IS CONSIDERED CARCINOGENIC BY ALL ROUTES OF EXPOSURE. ARSENIC AND HEXAVALENT CHROMIUM ARE CAPABLE OF CAUSING ACUTE AND CHRONIC NONCARCINOGENIC HEALTH EFFECTS IN HUMANS AT SUFFICIENT EXPOSURE LEVELS.

THE VWP SITE IS BORDERED BY RESIDENCES AND AGRICULTURAL LANDS, AND FROM LAND USE DEVELOPMENT PATTERNS, IT WAS ASSUMED IN THE RISK ASSESSMENT THAT BOTH ACTUAL AND POTENTIAL USES FOR THE SITE ARE RESIDENTIAL. IT WAS ALSO ASSUMED THAT UNDER CURRENT CONDITIONS IT IS UNLIKELY THAT EXPOSURE



TO HEAVILY CONTAMINATED SURFACE SOILS ON-SITE WILL OCCUR, SINCE MOST CONTAMINATED SOIL IS OVERLAIN BY ASPHALTIC PAVEMENT. HOWEVER, FUTURE RESIDENTIAL AND/OR INDUSTRIAL DEVELOPMENT WILL LIKELY OCCUR, WHICH MAY REQUIRE SOIL EXCAVATION TO A DEPTH OF 10 FEET; THEREFORE, EXPOSURE TO CONTAMINATED SOILS MAY OCCUR. POTENTIAL PATHWAYS OF CONTAMINANT MIGRATION FROM THE SITE TO THE SURROUNDING AREA INCLUDE AIR (WINDBLOWN DUST) AND GROUNDWATER.

A NUMBER OF EXPOSURE SCENARIOS IDENTIFYING EXPOSURES ASSOCIATED WITH CURRENT POTENTIAL AND FUTURE POTENTIAL LAND USE CONDITIONS WERE DEVELOPED. UNDER CURRENT POTENTIAL LAND USE CONDITIONS, THE EXPOSURES WITH THE HIGHEST PROBABILITY OF OCCURRING ARE RESIDENTIAL EXPOSURES ASSOCIATED WITH (1) INGESTION OF GROUNDWATER, (2) DERMAL CONTACT WITH GROUNDWATER, (3) INGESTION OF ON-SITE SOILS, (4) DERMAL CONTACT WITH ON-SITE SOILS, AND (5) INHALATION OF SUSPENDED PARTICULATES ON-AND OFF-SITE.

TO ASSESS CARCINOGENIC RISKS, THE FOLLOWING SLOPE FACTORS (MG/KG-DAY) WERE USED:

ARSENIC (INHALATION):	1.5 X (10 <sup>-1</sup> )	(SOURCE: IRIS)
ARSENIC (ORAL):	1.8 X (10 <sup>-1</sup> )	(SOURCE: IRIS)
CHROMIUM VI (INHALATION):	4.1 X (10 <sup>-1</sup> )	(SOURCE: IRIS)

TO ASSESS NONCARCINOGENIC EFFECTS, THE FOLLOWING REFERENCE DOSE VALUES (RFD; MG/KG-DAY) WERE USED:

ARSENIC (ORAL; DERMAL):	1.0 X (10 <sup>-2</sup> )	(SOURCE: HEAST)
CHROMIUM VI:	5 X (10 <sup>-3</sup> )	(SOURCE: IRIS)
CHROMIUM VI (ORAL):	2 X (10 <sup>-2</sup> )	(SOURCE: IRIS)
CHROMIUM VI (DERMAL):	1 X (10 <sup>-4</sup> )	(SOURCE: IRIS)

ASSUMPTIONS USED FOR SOIL EXPOSURE ASSESSMENT INCLUDED AN EXPOSURE FREQUENCY OF 365 DAYS PER YEAR, INGESTION RATE OF 100 MG PER DAY (ADULT) AND 200 MG PER DAY (CHILD), AN EXPOSURE DURATION (NONCARCINOGENIC EFFECTS) OF 30 YEARS (ADULT) AND 6 YEARS (CHILD), AND A LIFETIME EXPOSURE (FOR CARCINOGENIC EFFECTS) OF 70 YEARS. ASSUMPTIONS USED TO ASSESS GROUNDWATER EXPOSURE INCLUDED INGESTION OF 2 LITERS OF WATER PER DAY (ADULT) AND 1 LITER OF WATER PER DAY (CHILD) FOR THE SAME EXPOSURE DURATION AND FREQUENCY USED FOR SOIL EXPOSURE ASSESSMENT.

BASED ON THE RISK ASSESSMENT, IT WAS CONCLUDED THAT UNDER ACTUAL CURRENT LAND USE CONDITIONS, ADVERSE HEALTH EFFECTS ARE UNLIKELY. HOWEVER, AS LEVELS OF HEXAVALENT CHROMIUM HAVE INCREASED OVER TIME IN THE SHALLOW WELLS DOWNGRADIENT FROM THE SITE AND ARE EXPECTED TO INCREASE FOR AN UNKNOWN TIME IN THE ABSENCE OF REMEDIAL ACTION, INGESTION OF WELL WATER DOWNGRADIENT FROM THE SITE IS EXPECTED TO POSE A SIGNIFICANT HAZARD IN THE NEAR FUTURE. BASED ON THIS SCENARIO, TABLE 6-1 PRESENTS POTENTIAL HEALTH RISKS UNDER BASELINE (CURRENT LAND USE, NO REMEDIAL ALTERNATIVE) CONDITIONS. USING SIMULATED DATA, BASED ON SOLUTE TRANSPORT ANALYTICAL MODELING, GENERATED FOR THE DIXON-1 WELL, HAZARD INDICES (HI) OF 4 AND 8 WERE ESTIMATED FOR CHILDREN AND ADULTS, RESPECTIVELY. THESE VALUES EXCEED THE BENCHMARK VALUE OF 1 AND THEREFORE WARRANT PUBLIC HEALTH CONCERN. IT SHOULD BE NOTED THAT UNDER CURRENT LAND USE CONDITIONS, ARSENIC WILL NOT MOVE TO DOMESTIC WELLS.

POTENTIAL RISKS TO RESIDENTS UNDER FUTURE LAND USE CONDITIONS WERE ESTIMATED BOTH FOR AN AVERAGE EXPOSURE SCENARIO AND A REASONABLE MAXIMUM EXPOSURE (RME) SCENARIO. UNDER A RME SCENARIO, A RESIDENT IS ASSUMED TO BUILD A HOME ON-SITE ABOVE A SOIL HOT SPOT AND TO DRAW WATER FROM THE ARSENIC-CONTAMINATED WELLS. FOR THE OFF-SITE RESIDENT, WAS ASSUMED THAT A HOME IS BUILT SOUTH (DOWNWIND) OF THE SOIL HOT SPOT AND IS EXPOSED TO BOTH CONTAMINATED WATER AND DUST RELEASED FROM THE SITE.

TABLE 6-2 PRESENTS A SUMMATION OF RISKS ACROSS PATHWAYS FOR ON-SITE RESIDENTS UNDER FUTURE LAND USE CONDITIONS. THE CANCER RISK ASSOCIATED WITH THIS EXPOSURE POINT, COMBINING EXPOSURES VIA INGESTION, DERMAL CONTACT, AND INHALATION, IS A 1 IN 100 EXCESS RISK IN ADULTS AND A 6 IN 1,000 EXCESS RISK FOR CHILDREN, BASED ON AN RME ESTIMATE. THE MOST SIGNIFICANT POTENTIAL CANCER RISKS FOR ON-SITE RESIDENTS UNDER THIS CONDITION RESULT FROM EXPOSURE TO HIGH ARSENIC CONCENTRATIONS IN THE GROUNDWATER. INGESTION OF AND DERMAL CONTACT WITH GROUNDWATER AT THE ARSENIC-CONTAMINATED WELLS RESULT IN AN AVERAGE EXCESS CANCER RISK OF 9 IN 10,000 AND AN RME CANCER RISK OF 1 IN 100 FOR ADULTS. FOR CHILDREN, INGESTION OF GROUNDWATER RESULTS IN AN AVERAGE EXCESS CANCER RISK OF 1 IN 1,000 AND AN RME CANCER RISK OF 5 IN 1,000. HAZARD INDICES FOR AVERAGE AND RME ESTIMATES OF NONCARCINOGENIC TOXICITY ALSO FAR EXCEED THE BENCHMARK OF 1 (30 AND 40 FOR TOTAL RME RISK

ACROSS PATHWAYS FOR ADULTS AND CHILDREN, RESPECTIVELY).

TABLE 6-3 PRESENTS A SUMMATION OF RISKS ACROSS PATHWAYS FOR OFF-SITE RESIDENTS UNDER FUTURE LAND USE CONDITIONS. ACCORDING TO THESE ESTIMATES, CARCINOGENIC HEALTH EFFECTS EXCEED THE BENCHMARK VALUES  $1 \times (10^{-6})$  FOR THE RME SCENARIOS BUT NOT THE AVERAGE SCENARIOS. HAZARD INDICES, AS ESTIMATES OF NONCARCINOGENIC TOXICITY, EXCEED THE BENCHMARK VALUE OF 1 FOR BOTH RME AND AVERAGE SCENARIOS (50 AND 2 FOR TOTAL RME RISK ACROSS PATHWAYS FOR ADULTS AND CHILDREN, RESPECTIVELY). THE PATHWAY OF GREATEST CONCERN FOR NONCARCINOGENIC HAZARD IS INGESTION OF GROUNDWATER, WHEREAS THE PATHWAY OF GREATEST CONCERN FOR CARCINOGENIC RISKS IS INHALATION OF RESPIRABLE PARTICULATES. HEXAVALENT CHROMIUM IS DESIGNATED A CLASS A CARCINOGEN VIA INHALATION. ITS CONTRIBUTION TO THE CANCER RISK VIA THE INHALATION PATHWAY IS SOMEWHAT LESS THAN THE RISK ASSOCIATED WITH ARSENIC. FOR ADULTS AND CHILDREN, THE COMBINED CANCER RISK FOR AN AVERAGE EXPOSURE IS LESS THAN THE ONE IN A MILLION TARGET RISK LEVEL. HOWEVER, THE COMBINED EXCESS CANCER RISK FOR A REASONABLE MAXIMUM EXPOSURE IS THREE IN ONE MILLION FOR CHILDREN AND EIGHT IN ONE MILLION FOR ADULTS.

## 6.2 ENVIRONMENTAL RISKS

A PRELIMINARY ECOLOGICAL RISK ASSESSMENT WAS PERFORMED TO DETERMINE (1) IF ANY WETLANDS EXIST ON OR NEAR THE VWP SITE, AND (2) IF A COMPLETE ECOLOGICAL RISK ASSESSMENT IS REQUIRED.

THIS STUDY CONCLUDED THAT AQUATIC COMMUNITIES ARE UNLIKELY TO BE AFFECTED BY CONTAMINANTS ORIGINATING FROM THE VWP SITE. IT WAS DETERMINED THAT THERE ARE NO WETLANDS OR WATERCOURSES EITHER ON OR IN THE IMMEDIATE VICINITY OF THE SITE. CONTAMINATED GROUNDWATER UNDERLYING THE SITE AND ADJACENT AREAS DOES NOT DISCHARGE TO A NEARBY SURFACE WATERCOURSE. ALSO, THERE ARE NO KNOWN AQUATIC ENDANGERED OR THREATENED SPECIES AFFECTED BY CONTAMINANTS ORIGINATING FROM THE SITE. THE CALIFORNIA DEPARTMENT OF FISH AND GAME'S NATURAL DIVERSITY DATA BASE DID NOT INDICATE THE OCCURRENCE OF KNOWN ENDANGERED OR THREATENED AQUATIC SPECIES IN THE SITE VICINITY.

THE STUDY CONCLUDED THAT THERE ARE NO ENVIRONMENTALLY SENSITIVE AREAS AFFECTED BY SITE CONTAMINANTS. ALSO, IT IS UNLIKELY THAT MAMMALS OR BIRDS, INCLUDING KNOWN ENDANGERED OR THREATENED SPECIES, WOULD BE AFFECTED BY SITE CONTAMINANTS. THE CALIFORNIA DEPARTMENT OF FISH AND GAME'S NATURAL DIVERSITY DATA BASE DID NOT INDICATE THE OCCURRENCE OF KNOWN ENDANGERED OR THREATENED FLORAL OR FAUNAL SPECIES IN THE SITE VICINITY.

BASED ON THE RESULTS OF THE PRELIMINARY ECOLOGICAL RISK ASSESSMENT, A DETAILED ECOLOGICAL RISK ASSESSMENT WAS NOT PERFORMED.

## 6.3 CONCLUSION

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTIONS SELECTED IN THE ROD, MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH. THE CURRENT POTENTIAL RISK LEVEL (NONCARCINOGENIC) FROM OFF-SITE GROUNDWATER INGESTION PERTAINS TO A NONCARCINOGENIC RISK (HI) OF 4 AND 8 FOR CHILDREN AND ADULTS, RESPECTIVELY. FUTURE POTENTIAL CANCER RISKS FOR ON-SITE RESIDENTS ARE ESTIMATED TO BE AS HIGH AS  $1 \times (10^{-2})$  FOR ADULTS AND  $6 \times (10^{-3})$  FOR CHILDREN AND THE HI IS ESTIMATED TO BE AS HIGH AS 30 FOR ADULTS AND 40 FOR CHILDREN. FUTURE POTENTIAL CANCER RISK FOR OFF-SITE RESIDENTS IS ESTIMATED TO BE AS HIGH AS  $3 \times (10^{-6})$  FOR ADULTS AND  $8 \times (10^{-6})$  FOR CHILDREN. THE HI IS ESTIMATED TO BE AS HIGH AS 50 FOR ADULTS AND 2 FOR CHILDREN. EPA'S ACCEPTABLE EXCESS CANCER RISK RANGE IS  $1 \times (10^{-4})$  TO  $1 \times (10^{-6})$ , WHILE THAT FOR NONCARCINOGENIC RISK PERTAINS TO THE HI NOT EXCEEDING 1.

AQUATIC LIFE IS UNLIKELY TO BE AFFECTED BY SITE CONTAMINANTS. NO ENVIRONMENTALLY SENSITIVE AREAS, OR MAMMALS OR BIRDS ARE EXPECTED TO BE ADVERSELY AFFECTED BY THE CONTAMINANTS.

#DA

## 7.0 DESCRIPTION OF ALTERNATIVES

THE FOLLOWING DISCUSSION PRESENTS A BRIEF DESCRIPTION OF SOIL AND GROUNDWATER REMEDIAL ALTERNATIVES THAT HAVE SURVIVED THE PRELIMINARY SCREENING AND HAVE BEEN CARRIED THROUGH A DETAILED ANALYSIS IN THE VWP SITE FEASIBILITY STUDY (FS) REPORT. TABLE 7-1 LISTS THE ALTERNATIVES SUBJECT TO DETAILED EVALUATION IN THE FS. THE SOIL AND GROUNDWATER CLEANUP STANDARDS HAVE BEEN DESCRIBED IN SECTION 4.0 OF THIS DOCUMENT.

THE PRESENT WORTH COSTS FOR THE REMEDIAL ALTERNATIVES ARE BASED ON CAPITAL AND O&M COSTS, 5 PERCENT DISCOUNT RATE, AND THE PERIOD OF PERFORMANCE DEFINED FOR EACH ALTERNATIVE. ALL COSTS ARE IN JANUARY 1991 DOLLARS. TO AVOID DUPLICATION OF COSTS, ANNUAL O&M COSTS PERTAINING TO 30 YEARS OF GROUNDWATER MONITORING, ARE NOT INCLUDED IN THE COSTS FOR SOIL REMEDIAL ALTERNATIVES, AS THEY ARE INCLUDED IN THE GROUNDWATER REMEDIAL ALTERNATIVES COSTS.

## 7.1 SOIL REMEDIAL ALTERNATIVES

### ALTERNATIVE 1--NO ACTION

UNDER THIS ALTERNATIVE, NO REMEDIAL ACTIVITY WOULD OCCUR. AT LEAST 15,000 CUBIC YARDS OF CONTAMINATED SOILS WOULD BE LEFT IN PLACE AND CONTAMINATED GROUNDWATER WOULD CONTINUE TO MOVE OFF-SITE. ACCESS TO THE SITE WOULD CONTINUE TO BE RESTRICTED BY THE EXISTING 6-FOOT-HIGH PERIMETER FENCE. WARNING SIGNS WOULD BE POSTED AT 100-FOOT INTERVALS ALONG THE FENCE AND AT THE ENTRANCE GATE, WHICH WOULD BE SECURELY LOCKED. CONTINUED GROUNDWATER MONITORING WOULD BE REQUIRED. NO RISK REDUCTION WOULD RESULT. THE ALTERNATIVE WOULD NOT COMPLY WITH ARARS OR WATER QUALITY STANDARDS. THE COST OF THIS ALTERNATIVE, PRIMARILY FOR GROUNDWATER MONITORING, IS DISCUSSED UNDER SECTION 7.2 (GROUNDWATER REMEDIAL ALTERNATIVES), ALTERNATIVE A - NO ACTION, TO AVOID DUPLICATION OF COSTS.

### ALTERNATIVE 2--CAPPING

THIS ALTERNATIVE INVOLVES CAPPING SOILS CONTAINING ABOVE-BACKGROUND CONCENTRATIONS OF HEXAVALENT CHROMIUM AND/OR ARSENIC. THE DESIGN OBJECTIVE OF THE CAP WOULD BE TO MINIMIZE THE INFILTRATION OF WATER THROUGH THE METAL-CONTAMINATED SOIL AND PREVENT EXPOSURE OF THIS SOIL TO THE ATMOSPHERE AND TO POTENTIAL RECEPTORS. THE CAP WOULD ALSO BE DESIGNED TO PROMOTE RUNOFF AND DRAINAGE AWAY FROM THE IMPACTED AREAS. TO THE EXTENT POSSIBLE, THE EXISTING ASPHALT- AND CONCRETE-PAVED AREAS WOULD BE REPAIRED AND SEALED. THE UNPAVED AREAS UNDERLAIN BY ELEVATED CONCENTRATIONS OF HEXAVALENT CHROMIUM AND ARSENIC WOULD BE GRADED AND PAVED USING AN APPROPRIATE LOW PERMEABILITY PAVING MATERIAL. LONG-TERM MAINTENANCE WOULD BE REQUIRED TO PRESERVE THE INTEGRITY OF THE PAVING. IT IS ESTIMATED THAT AN AREA OF APPROXIMATELY 17,000 SQUARE FEET (FT<sup>2</sup>) WOULD REQUIRE PAVING AND APPROXIMATELY 41,000 FT<sup>2</sup> WOULD REQUIRE REPAIR AND SEALING. THE CURRENTLY UNPAVED AREA AFFECTED BY ABOVE-BACKGROUND CONCENTRATIONS OF METALS IS LOCATED, FOR THE MOST PART, EAST OF THE NORTHERN DEPRESSION. AS AT LEAST 15,000 CUBIC YARDS OF CONTAMINATED SOIL WOULD BE LEFT IN PLACE UNTREATED, LONG-TERM CAP MAINTENANCE, INSTITUTIONAL CONTROLS, AND SITE (GROUNDWATER) MONITORING WOULD BE REQUIRED FOR THIS ALTERNATIVE TO REMAIN PROTECTIVE. THIS ALTERNATIVE WILL NOT MEET THE GROUNDWATER ARARS. CAPPING IS NOT A FULLY PERMANENT ALTERNATIVE AND IT WOULD NOT REDUCE TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT. THE CAPITAL, ANNUAL OPERATION AND MAINTENANCE (O&M), AND PRESENT WORTH COSTS FOR THIS ALTERNATIVE ARE \$78,000, \$138,000, AND \$216,000, RESPECTIVELY, BASED ON 30 YEARS.

### ALTERNATIVE 3--IN-SITU FLUSHING, EXCAVATION, FIXATION, AND ON-SITE DISPOSAL

ALTERNATIVE 3 COMBINES THE IN-SITU FLUSHING OF SOILS CONTAINING ELEVATED CONCENTRATIONS OF HEXAVALENT CHROMIUM WITH THE EXCAVATION AND CHEMICAL FIXATION OF ARSENIC-CONTAINING SOIL. THE IN-SITU SOIL FLUSHING WOULD BE PERFORMED IN CONJUNCTION WITH GROUNDWATER EXTRACTION AND TREATMENT. THE EXISTING ASPHALT AND CONCRETE PAVEMENT WOULD BE REMOVED IN THE RETORT/WOOD PRESERVING AREA AND IN THE VICINITY OF THE NORTHERN PAVED DEPRESSION. FLUSHING BASINS WOULD BE CONSTRUCTED IN EACH OF THESE TWO AREAS. WATER WOULD BE PONDED IN THE FLUSHING BASINS TO INFILTRATE THROUGH THE SOIL. AN EFFECTIVE GROUNDWATER EXTRACTION SYSTEM WOULD BE INSTALLED DOWNGRADIENT OF THE FLUSHING BASINS TO CAPTURE THE ELUTRIATE. THE EXTRACTED GROUNDWATER WOULD BE TREATED TO MEET GROUNDWATER CLEANUP STANDARDS BEFORE REAPPLICATION TO THE FLUSHING BASINS. SUBSEQUENT TO ACHIEVING THE TARGET CLEANUP GOAL FOR HEXAVALENT CHROMIUM-CONTAMINATED SOILS, THE FLUSHING BASINS WOULD CONTINUE IN OPERATION SOLELY AS A MEANS OF DISCHARGING TREATED GROUNDWATER.

BECAUSE OF ARSENIC'S LOW LEACHABILITY, SOIL FLUSHING IS NOT EXPECTED TO HAVE A SIGNIFICANT MITIGATING EFFECT ON ARSENIC-CONTAMINATED SOIL. HOWEVER, THE MOST SOLUBLE FRACTIONS OF ARSENIC COMPOUNDS WOULD LEACH DURING THE INITIAL STAGES OF SOIL FLUSHING AND THE CONCENTRATION OF ARSENIC WOULD DECREASE THEREAFTER. CLEANUP OF ARSENIC-CONTAMINATED SOIL WOULD BE PERFORMED BY EXCAVATION AND ON-SITE, ABOVEGROUND CHEMICAL FIXATION. THE TREATED SOIL COULD BE USED AS BACKFILL AT THE SITE. (CHEMICAL FIXATION IS DISCUSSED AS A SEPARATE REMEDIAL ALTERNATIVE UNDER ALTERNATIVE 4 BELOW.)

THE IN-SITU FLUSHING WOULD INVOLVE APPROXIMATELY 8,000 CUBIC YARDS OF SOILS CONTAINING ELEVATED CONCENTRATIONS OF HEXAVALENT CHROMIUM. THE EXCAVATION, FIXATION, AND ON-SITE DISPOSAL WOULD INVOLVE APPROXIMATELY 9,000 CUBIC YARDS OF PRIMARILY SURFACE SOILS CONTAMINATED WITH ARSENIC. THE TIME TO ACHIEVE CLEANUP WOULD BE APPROXIMATELY 5 YEARS.

TREATABILITY STUDIES USING SITE SOILS WOULD BE PERFORMED BEFORE REMEDIAL DESIGN. THIS ALTERNATIVE, IF IMPLEMENTED, WOULD MEET ARARS AND REDUCE THE POTENTIAL EXCESS CANCER RISK TO 1 X (10<sup>-6</sup>) LEVEL. INSTITUTIONAL CONTROLS WOULD BE PUT IN PLACE TO ENSURE THAT FUTURE LAND USE PRACTICES ARE COMPATIBLE WITH THE FIXED-SOIL MASS. THE RISK POSED BY THE SITE WOULD BE REASSESSED AT 5-YEAR INTERVALS AFTER CLEANUP TO CONFIRM THAT THIS REMEDY CONTINUES TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT. THE CAPITAL, ANNUAL O&M, AND PRESENT WORTH COSTS ARE \$1,232,000, \$21,000, AND \$1,323,000; RESPECTIVELY, BASED ON 5 YEARS OF OPERATION TO ACHIEVE CLEANUP. ANNUAL O&M COSTS PERTAINING TO GROUNDWATER MONITORING ARE NOT INCLUDED IN THIS ALTERNATIVE, AS THEY ARE ALREADY INCLUDED IN THE COSTS FOR GROUNDWATER REMEDIAL ALTERNATIVES.

#### ALTERNATIVE 4--EXCAVATION, FIXATION, AND ON-SITE DISPOSAL

THIS ALTERNATIVE INVOLVES THE EXCAVATION AND CHEMICAL FIXATION OF SURFACE SOIL (0 TO 4 FEET) CONTAINING HEXAVALENT CHROMIUM, AND ARSENIC EXCEEDING THE 1 X (10<sup>-6</sup>) EXCESS CANCER RISK. IN ADDITION, SUBSURFACE SOILS (FROM 4 FEET BELOW SURFACE TO GROUNDWATER) ABOVE LEVELS CONSIDERED TO BE PROTECTIVE OF GROUNDWATER WOULD BE EXCAVATED AND CHEMICALLY FIXED. THE TOTAL VOLUME OF SUCH SOIL IS ESTIMATED AT APPROXIMATELY 15,000 CUBIC YARDS. THE TIME TO ACHIEVE CLEANUP FROM THE BEGINNING OF THE REMEDIAL ACTION WOULD BE APPROXIMATELY 9 MONTHS.

EXCAVATION WOULD BE PERFORMED USING CONVENTIONAL EARTHMOVING EQUIPMENT. THE EXCAVATED SOIL WOULD BE BLENDED WITH COMMERCIALY AVAILABLE CHEMICAL STABILIZING AGENTS (SUCH AS PORTLAND CEMENT) IN MIXING EQUIPMENT SIMILAR TO A CONCRETE BATCHING PLANT. THE FIXED-SOIL MATRIX WOULD BE USED TO BACKFILL THE EXCAVATION. THE PURPOSE OF THE TREATMENT IS TO STABILIZE THE CONTAMINANTS AND PREVENT MOBILIZATION. THE STABILIZED SOIL MASS WOULD ELIMINATE FUGITIVE DUST EMISSIONS, PREVENT SURFACE WATER EROSION OF CONTAMINATED SOIL, AND REDUCE LEACHABILITY OF CONTAMINANTS.

TREATABILITY STUDIES USING SITE SOILS WILL BE PERFORMED DURING REMEDIAL DESIGN. MEASURES SUCH AS COVERS OF CLEAN SOIL AND VEGETATION OR A CLAY CAP WOULD BE TAKEN TO PROTECT THE SURFACE OF THE FIXED-SOIL MASS FROM PHYSICAL DECOMPOSITION. INSTITUTIONAL CONTROLS WOULD BE PUT IN PLACE TO ENSURE THAT FUTURE LAND-USE PRACTICES ARE COMPATIBLE WITH THE FIXED-SOIL MASS. THIS ALTERNATIVE, IF IMPLEMENTED, WOULD MEET ARARS AND REDUCE THE POTENTIAL EXCESS CANCER RISK TO 1 X (10<sup>-6</sup>) LEVEL. THE RISK POSED BY THE SITE WOULD BE REASSESSED AT 5-YEAR INTERVALS TO CONFIRM THAT THIS REMEDY CONTINUES TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT. THE CAPITAL, O&M, AND PRESENT WORTH COSTS FOR THIS ALTERNATIVE ARE \$1,853,000, \$0, AND \$1,853,000, RESPECTIVELY, BASED ON LESS THAN ONE YEAR OF OPERATION TO ACHIEVE CLEANUP. ANNUAL O&M COSTS PRIMARILY FOR GROUNDWATER MONITORING ARE INCLUDED IN THE GROUNDWATER REMEDIAL ALTERNATIVES COSTS.

## 7.2 GROUNDWATER REMEDIAL ALTERNATIVES

#### ALTERNATIVE A--NO ACTION

THIS REMEDIAL ALTERNATIVE FEATURES A NO-ACTION RESPONSE TO GROUNDWATER CONTAINING HEXAVALENT CHROMIUM AND ARSENIC. UNDER THIS ALTERNATIVE, THE EXISTING INTERIM GROUNDWATER CLEANUP PROGRAM WOULD BE TERMINATED, RESULTING IN UNCONTROLLED MIGRATION OF THE HEXAVALENT CHROMIUM AND ARSENIC IN THE AQUIFER. THE MIGRATING CHEMICALS, PARTICULARLY HEXAVALENT CHROMIUM, COULD ULTIMATELY REACH THE ACTIVE DOMESTIC WATER SUPPLY WELLS LOCATED HYDRAULICALLY DOWNGRADIENT OF THE SITE. THE RISKS ASSOCIATED WITH EXPOSURE TO THE CHEMICALS IN GROUNDWATER WOULD REMAIN UNCHANGED, ALTHOUGH DECREASES IN THE CONCENTRATIONS OF HEXAVALENT CHROMIUM AND ARSENIC WOULD BE EXPECTED AT SOME FUTURE TIME DUE TO NATURAL ATTENUATION AND DISPERSION. GROUNDWATER MONITORING WOULD BE REQUIRED DURING IMPLEMENTATION OF THE NO-ACTION RESPONSE. THIS ALTERNATIVE WOULD NOT COMPLY WITH ARARS. THE CAPITAL, O&M, AND PRESENT WORTH COSTS FOR THIS ALTERNATIVE ARE \$39,000, \$77,000, AND \$1,223,000, RESPECTIVELY, PRIMARILY BASED ON 30 YEARS OF GROUNDWATER MONITORING.

#### ALTERNATIVE B--IN-SITU TREATMENT AND HYDRAULIC CONTROL

THIS ALTERNATIVE WOULD INVOLVE THE IN-SITU TREATMENT OF HEXAVALENT CHROMIUM AND ARSENIC-CONTAMINATED GROUNDWATER USING FERROUS IONS GENERATED BY AN ON-SITE, ABOVE-GROUND FERROUS ION GENERATOR. THE FERROUS IONS WOULD BE INTRODUCED TO THE AQUIFER, IN SOLUTION, VIA INJECTION WELLS, INFILTRATION GALLERIES, AND/OR INFILTRATION PONDS. INJECTION WELLS WOULD BE

USED IN OFF-SITE AREAS, AND INFILTRATION PONDS WOULD BE USED ON-SITE. THE EXISTING EXTRACTION WELLS, AS WELL AS ADDITIONAL EXTRACTION WELLS NEAR THE DOWNGRAIENT EDGE OF THE PLUME, WOULD ENHANCE THE MIGRATION OF FERROUS IONS THROUGH THE AQUIFER WHILE HYDRAULICALLY CONTAINING THE PLUME.

CONTAMINATED GROUNDWATER WOULD BE EXTRACTED FROM THE AQUIFER VIA AN EXPANDED EXTRACTION SYSTEM CONSISTING OF APPROXIMATELY SIX EXTRACTION WELLS AT A RATE OF ABOUT 250 GALLONS PER MINUTE (GPM). THE CONTAMINATED GROUNDWATER WOULD BE TRANSFERRED BACK TO THE SITE FOR ELECTROCHEMICAL TREATMENT USING THE EXISTING FERROUS ION GENERATOR. DEPENDING ON THE ARSENIC CONTENT OF THE TREATMENT SYSTEM INFLUENT, IT MAY BE NECESSARY TO POLISH THE EFFLUENT USING ACTIVATED ALUMINA ADSORPTION. THE TREATED WATER WOULD BE TRANSFERRED TO THE 600,000-GALLON HOLDING TANK WHERE PRECIPITATION AND SETTLING WOULD OCCUR. THE TREATMENT PROCESS WOULD GENERATE SLUDGE CONTAINING ELEVATED METAL CONCENTRATIONS AND REQUIRING SPECIAL HANDLING AND DISPOSAL AT AN OFF-SITE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH STATE AND FEDERAL REGULATIONS. TREATED WATER WOULD BE DRAWN FROM THE HOLDING TANK AND PUMPED TO A MIXING TANK WHERE FERROUS IONS FROM A SECOND FERROUS ION GENERATOR WOULD BE ADDED. THE FERROUS ION-CONTAINING SOLUTION WOULD BE PUMPED FROM THE MIXING TANK AND DELIVERED TO THE ON-SITE INFILTRATION PONDS AND THE OFF-SITE INJECTION WELLS. DISSOLVED HEXAVALENT CHROMIUM AND ARSENIC WOULD BE IMMOBILIZED IN SITU AND ADSORBED ONTO THE SOIL MATRIX. GROUNDWATER TREATED IN SITU WOULD BE EXTRACTED DOWNSTREAM FOR ADDITIONAL, ABOVE-GROUND TREATMENT USING FERROUS IONS, THEN RECYCLED THROUGH THE SYSTEM.

A BENCH-SCALE TEST WAS PERFORMED AT THE SITE TO DETERMINE THE IMPACT OF FERROUS IONS ON THE IN-SITU CONVERSION OF HEXAVALENT CHROMIUM TO TRIVALENT CHROMIUM. THE RESULTS OF THIS TEST DEMONSTRATED THAT IN-SITU GROUNDWATER TREATMENT IS FEASIBLE AND SHOULD BE FURTHER EVALUATED ON A PILOT-SCALE LEVEL. BENCH-SCALE TESTS INDICATE THAT THIS ALTERNATIVE MAY ACHIEVE TARGET CLEANUP GOALS ESTABLISHED FOR GROUNDWATER. A PASSAGE OF AT LEAST THREE PORE VOLUMES OF SOLUTION, CORRESPONDING TO AT LEAST THREE YEARS OF PUMP AND TREAT, IS ESTIMATED TO BE REQUIRED TO ACHIEVE TARGET CLEANUP CONCENTRATIONS. PILOT-SCALE TESTING WILL BE REQUIRED TO CONFIRM OR REFINES THESE CONCLUSIONS AND ESTIMATES.

BASED ON BENCH-SCALE TESTING, THIS ALTERNATIVE WILL BE ABLE TO MEET ARARS. HOWEVER, PILOT-SCALE TESTING WILL ADDRESS UNCERTAINTIES IN THE ABILITY OF THIS ALTERNATIVE TO COMPLY WITH THE GROUNDWATER ARARS AND CLEANUP STANDARDS WITHIN THE ENTIRE AQUIFER.

THE CAPITAL, ANNUAL O&M, AND PRESENT WORTH COSTS FOR THIS ALTERNATIVE ARE \$254,000, \$245,000 (\$168,000 FOR REMEDIATION AND \$77,000 FOR GROUNDWATER MONITORING), AND \$1,895,000, RESPECTIVELY. THIS IS BASED ON 3 YEARS OF OPERATION TO ACHIEVE CLEANUP, AND 30 YEARS OF O&M INCLUDING GROUNDWATER MONITORING.

#### ALTERNATIVE C1-- GROUNDWATER EXTRACTION, ELECTROCHEMICAL TREATMENT, AND ACTIVATED ALUMINA ADSORPTION

THIS ALTERNATIVE INVOLVES THE EXTRACTION OF HEXAVALENT CHROMIUM-AND-ARSENIC-CONTAINING GROUNDWATER, FOLLOWED BY ABOVE-GROUND ELECTROCHEMICAL TREATMENT (SIMILAR TO THAT CURRENTLY BEING USED IN THE INTERIM CLEANUP PROGRAM) TO REMOVE DISSOLVED HEXAVALENT CHROMIUM, FOLLOWED BY ACTIVATED ALUMINA ADSORPTION TO REMOVE RESIDUAL DISSOLVED ARSENIC. THE GROUNDWATER EXTRACTION SYSTEM WOULD CONSIST OF THE EXISTING INTERIM PUMP-AND-TREAT SYSTEM SUPPLEMENTED BY ADDITIONAL EXTRACTION WELLS NEAR THE LEADING EDGE OF THE PLUME. A MINIMUM OF SIX EXTRACTION WELLS PUMPING AT A COMBINED RATE OF ABOUT 250 GPM WOULD BE NEEDED. IT IS EXPECTED THAT THE REMOVAL OF AT LEAST 5 PORE VOLUMES WOULD BE REQUIRED TO ACHIEVE THE TARGET CLEANUP LEVELS FOR GROUNDWATER (50 PPB FOR HEXAVALENT CHROMIUM AND 16 PPB FOR ARSENIC), CORRESPONDING TO A CLEANUP TIME OF AT LEAST 5 YEARS. THE TIME ESTIMATE FOR AQUIFER CLEANUP IS BASED ON THE ASSUMPTION THAT DESORPTION OF HEXAVALENT CHROMIUM IS UNIFORM THROUGHOUT THE TARGET ZONE. THIS ASSUMPTION WILL BE VERIFIED BY EVALUATING THE WATER QUALITY DATA DURING FULL-SCALE CLEANUP OPERATIONS.

EXTRACTED GROUNDWATER WOULD BE TRANSFERRED TO THE 600,000-GALLON HOLDING TANK. FERROUS IONS FROM THE FERROUS ION GENERATOR WOULD BE INJECTED CONTINUOUSLY INTO THE WATER TRANSFER PIPING WHERE MIXING WOULD OCCUR. THE REDUCTION OF HEXAVALENT CHROMIUM TO ITS TRIVALENT FORM WOULD OCCUR IN THE PIPING AND IN THE HOLDING TANK. THE REDUCED CHROMIUM WOULD PRECIPITATE OUT IN THE HOLDING TANK. THE ELECTROCHEMICAL PROCESS SHOULD BE CAPABLE OF REDUCING ARSENIC CONCENTRATIONS. IF REQUIRED, TREATED EFFLUENT WOULD BE TRANSFERRED TO THE ALUMINA-ADSORPTION COLUMN FOR SECONDARY TREATMENT TO REMOVE RESIDUAL ARSENIC. ONCE TREATED, THE EFFLUENT WOULD BE DISCHARGED TO ONE OR MORE PERCOLATION PONDS FOR INFILTRATION AND EVAPORATION. SUBSURFACE INJECTION WELLS

COULD BE USED AS A COMPLEMENTARY OPTION FOR DISCONTINUOUS OR INTERMITTENT DISCHARGE. THE TREATMENT PROCESS WOULD GENERATE SLUDGE CONTAINING ELEVATED METAL CONCENTRATIONS AND REQUIRING SPECIAL HANDLING AND DISPOSAL AT AN OFF-SITE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH STATE AND FEDERAL REGULATIONS.

THIS ALTERNATIVE WILL MEET ALL ARARS FOR THE ACTION. INSTITUTIONAL CONTROLS TO PREVENT ACCESS TO THE CONTAMINATED AQUIFER WOULD BE NECESSARY WHILE THE ACTION IS BEING IMPLEMENTED. THE AREA OF ATTAINMENT OF CLEANUP STANDARDS IS THE ENTIRE AQUIFER.

THE CAPITAL, ANNUAL O&M, AND PRESENT WORTH COSTS FOR THIS ALTERNATIVE ARE \$177,000, \$224,000 (\$147,000 FOR REMEDIATION AND \$77,000 FOR GROUNDWATER MONITORING), AND \$1,997,000, RESPECTIVELY, BASED ON 5 YEARS OF OPERATION TO ACHIEVE CLEANUP AND 30 YEARS OF O&M INCLUDING GROUNDWATER MONITORING.

ALTERNATIVE C2-- GROUNDWATER EXTRACTION, CHEMICAL REDUCTION/PRECIPITATION, AND ACTIVATED ALUMINA ADSORPTION

THIS ALTERNATIVE WOULD INVOLVE ALL OF THE PROCESS STEPS INCLUDED IN ALTERNATIVE C1 EXCEPT THAT ELECTROCHEMICAL TREATMENT WOULD BE REPLACED WITH CHEMICAL REDUCTION/PRECIPITATION. DURING THE CHEMICAL REDUCTION/PRECIPITATION PROCESS, A REDUCING AGENT WOULD BE ADDED TO THE EXTRACTED GROUNDWATER TO TRANSFORM HEXAVALENT CHROMIUM INTO ITS NONTOXIC TRIVALENT FORM. THE REDUCTION PROCESS WOULD TAKE PLACE UNDER HIGHLY ACIDIC CONDITIONS. THE EFFLUENT FROM THE REDUCING PROCESS WOULD BE TRANSFERRED TO THE 600,000-GALLON HOLDING TANK AND GIVEN SUFFICIENT TIME FOR PRECIPITATION OF TRIVALENT CHROMIUM. THE EFFLUENT WOULD BE TRANSFERRED TO THE ALUMINA-ADSORPTION COLUMN TO REMOVE RESIDUAL ARSENIC. ALL OTHER ASPECTS, INCLUDING CLEANUP GOALS, TIME FRAME FOR COMPLETION, AND EFFLUENT AND RESIDUALS MANAGEMENT, WOULD REMAIN THE SAME AS THOSE UNDER ALTERNATIVE C1.

THIS ALTERNATIVE WILL MEET ALL ARARS FOR THE ACTION. INSTITUTIONAL CONTROLS TO PREVENT ACCESS TO THE CONTAMINATED AQUIFER WOULD BE NECESSARY WHILE THE ACTION IS BEING IMPLEMENTED. THE AREA OF ATTAINMENT OF CLEANUP STANDARDS IS THE ENTIRE AQUIFER.

THE CAPITAL, ANNUAL O&M, AND PRESENT WORTH COSTS FOR THIS ALTERNATIVE ARE \$369,000, \$396,000 (\$319,000 FOR REMEDIATION AND \$77,000 FOR GROUNDWATER MONITORING), AND \$2,934,000, RESPECTIVELY. THIS IS BASED ON 5 YEARS OF OPERATION TO ACHIEVE CLEANUP AND 30 YEARS OF O&M INCLUDING GROUNDWATER MONITORING.

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### **8.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES**

AN EVALUATION AND COMPARISON OF THE ALTERNATIVES ARE PRESENTED IN THIS SECTION. THE COMPARISON IS BASED ON THE NINE KEY CRITERIA REQUIRED UNDER THE NATIONAL CONTINGENCY PLAN AND CERCLA SECTION 121 FOR USE IN EVALUATION OF REMEDIAL ALTERNATIVES BY EPA. THE NINE CRITERIA ARE AS FOLLOWS:

- OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
- COMPLIANCE WITH ARARS (SEE TABLE 8-1 FOR ARARS AND TBSCS EVALUATED)
- LONG-TERM EFFECTIVENESS AND PERMANENCE
- REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT
- SHORT-TERM EFFECTIVENESS
- IMPLEMENTABILITY
- COST
- STATE ACCEPTANCE
- COMMUNITY ACCEPTANCE

#### **8.1 ALTERNATIVE COMPARISON FOR SOILS**

TABLE 8-2 PRESENTS A COMPARISON OF REMEDIAL ALTERNATIVES FOR SOILS TREATMENT.

#### **8.2 ALTERNATIVE COMPARISON FOR GROUNDWATER**

TABLE 8-3 PRESENTS A COMPARISON OF REMEDIAL ALTERNATIVES FOR GROUNDWATER TREATMENT. NOTE THAT, EXCEPT FOR COST, THE EVALUATIONS OF ALTERNATIVES C1 AND C2 ARE IDENTICAL.

### 8.3 REMEDY SELECTION RATIONALE

A COMPARISON OF ALTERNATIVES BY THE NINE SELECTION CRITERIA AND RATIONALE FOR SITE-REMEDY SELECTION ARE DISCUSSED IN THIS SECTION. THE CRITERIA USED IN SELECTING EACH REMEDY ARE SUMMARIZED IN TABLE 8-4.

#### 8.3.1 SOIL

##### ALTERNATIVES ASSESSED

1. NO ACTION (NO ACTION)
2. CAPPING (CAPPING)
3. IN-SITU FLUSHING, EXCAVATION, FIXATION, AND ON-SITE DISPOSAL (FLUSHING)
4. EXCAVATION, FIXATION, AND ON-SITE DISPOSAL (FIXATION)

##### CRITERIA ASSESSMENT

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT -- NO ACTION WOULD NOT BE PROTECTIVE OF HUMAN HEALTH OR THE ENVIRONMENT; CONTINUED RELEASES OF SITE CONTAMINANTS INTO THE ENVIRONMENT WOULD OCCUR. CAPPING WOULD PREVENT DIRECT CONTACT AND INHALATION AND REDUCE SURFACE WATER RUNOFF RISK; BUT IT WOULD ONLY BE PARTIALLY PROTECTIVE OF GROUNDWATER AND WOULD LEAVE GROUNDWATER AND SOIL CONTAMINATION ON-SITE. FLUSHING MAY NOT BE TOTALLY PROTECTIVE OF GROUNDWATER, AS SITE CONDITIONS MAY LIMIT THE FEASIBILITY OF THIS ALTERNATIVE. FIXATION WOULD BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.

COMPLIANCE WITH ARARS -- NO ACTION WOULD NOT COMPLY WITH FEDERAL AND STATE ARARS. CAPPING OF SOILS WOULD NOT ADDRESS GROUNDWATER PROTECTION ARARS. FLUSHING MAY NOT ACHIEVE FULL COMPLIANCE WITH GROUNDWATER ARARS. FIXATION WOULD ACHIEVE FULL COMPLIANCE WITH THE ARARS.

LONG-TERM EFFECTIVENESS AND PERMANENCE -- NO ACTION WOULD NOT OFFER ANY LONG-TERM EFFECTIVENESS. CAPPING COULD REMAIN EFFECTIVE FOR PREVENTING SURFACE EXPOSURE AS LONG AS THE CAP WERE MAINTAINED. CAPPING WOULD NOT PROVIDE LONG-TERM PROTECTION OF GROUNDWATER. LONG-TERM EFFECTIVENESS FOR FLUSHING IS UNCERTAIN, AS IT MAY NOT BE FULLY EFFECTIVE FOR GROUNDWATER PROTECTION. LONG-TERM EFFECTIVENESS FOR FIXATION WOULD BE DEPENDENT ON THE LONG-TERM MAINTENANCE AND MONITORING OF THE FIXED-SOIL MASS AND LINER SYSTEM USED TO CONTROL LEACHATE. IF IMPLEMENTED PROPERLY AND INSTITUTIONAL CONTROLS ARE MAINTAINED, FIXATION IS EXPECTED TO PROVIDE LONG-TERM EFFECTIVENESS.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (TMV) THROUGH TREATMENT -- NO ACTION WOULD NOT ACHIEVE A TMV REDUCTION. CAPPING WOULD REDUCE SURFACE MOBILITY BUT VERY LITTLE GROUNDWATER MOBILITY. FLUSHING WOULD REDUCE TOXICITY AND MOBILITY BUT WOULD INCREASE VOLUME OF TREATED SOIL. FIXATION WOULD REDUCE MOBILITY THROUGH TREATMENT AND CONTAINMENT. NO REDUCTION IN TOXICITY WOULD OCCUR AND VOLUME OF SOIL WOULD INCREASE DUE TO THE ADDITION OF FIXING AGENTS.

SHORT-TERM EFFECTIVENESS -- ALL ALTERNATIVES COULD BE IMPLEMENTED TO BE PROTECTIVE OF WORKERS AND THE COMMUNITY DURING REMEDIAL ACTION. CAPPING WOULD POSE THE LEAST RISK DURING IMPLEMENTATION, AS MINIMAL AMOUNTS OF CONTAMINANTS WOULD BE HANDLED.

IMPLEMENTABILITY -- ALL ALTERNATIVES ARE IMPLEMENTABLE, AND EQUIPMENT AND SERVICES ARE READILY AVAILABLE.

COST -- NO ACTION WOULD COST \$1.223 MILLION, PRIMARILY FOR GROUNDWATER MONITORING; CAPPING WOULD COST \$216,000; FLUSHING WOULD COST \$1.323 MILLION; AND FIXATION WOULD COST \$1.853 MILLION (PRESENT WORTH COSTS).

STATE ACCEPTANCE -- NO ACTION AND CAPPING WOULD NOT BE ACCEPTABLE TO THE STATE. FLUSHING WOULD NOT BE ACCEPTABLE UNTIL ITS EFFECTIVENESS IS PROVEN FOR THE SITE. FIXATION WOULD BE THE MOST ACCEPTABLE ALTERNATIVE.

COMMUNITY ACCEPTANCE -- NO ACTION AND CAPPING WOULD NOT BE ACCEPTABLE TO THE COMMUNITY. FLUSHING WOULD NOT BE ACCEPTABLE UNTIL ITS EFFECTIVENESS IS PROVEN FOR THE SITE. FIXATION WOULD BE THE MOST ACCEPTABLE ALTERNATIVE.

## REMEDY SELECTION RATIONALE

EPA HAS SELECTED EXCAVATION, FIXATION, AND ON-SITE DISPOSAL AS THE REMEDY FOR SOILS. THIS ALTERNATIVE BEST PROTECTS HUMAN HEALTH AND THE ENVIRONMENT AND IS THE ONLY ALTERNATIVE THAT COMPLIES WITH ALL ARARS. EVEN THROUGH IT IS MORE COSTLY THAN FLUSHING, FIXATION IS MORE EFFECTIVE AND IS MORE ACCEPTABLE TO THE STATE AND THE COMMUNITY BECAUSE SOIL FLUSHING IS COMPLETELY UNPROVEN AT THIS SITE AND SITE CONDITIONS MAY LIMIT ITS FEASIBILITY.

### 8.3.2 GROUNDWATER

#### ALTERNATIVES ASSESSED

- A. NO ACTION (NO ACTION)
- B. IN-SITU CHEMICAL TREATMENT, AND HYDRAULIC CONTROL (IN-SITU TREATMENT)
- C1. GROUNDWATER EXTRACTION, ELECTROCHEMICAL TREATMENT, AND ACTIVATED ALUMINA ADSORPTION (ELECTROCHEMICAL TREATMENT)
- C2. GROUNDWATER EXTRACTION, CHEMICAL REDUCTION/PRECIPITATION, AND ACTIVATED ALUMINA ADSORPTION (CHEMICAL REDUCTION)

#### CRITERIA ASSESSMENT

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT -- NO ACTION WOULD NOT BE PROTECTIVE OF HUMAN HEALTH OR THE ENVIRONMENT. IN-SITU TREATMENT MAY NOT BE TOTALLY PROTECTIVE OF HUMAN HEALTH, AS INSUFFICIENT DATA EXIST TO DEMONSTRATE THE EFFECTIVENESS OF THIS TECHNOLOGY. BOTH ELECTROCHEMICAL TREATMENT AND CHEMICAL REDUCTION WOULD BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND WOULD CONTAIN THE PLUME.

COMPLIANCE WITH ARARS -- NO ACTION WOULD NOT COMPLY WITH ARARS. IN-SITU TREATMENT MAY NOT FULLY COMPLY WITH GROUNDWATER ARARS. BOTH ELECTROCHEMICAL TREATMENT AND CHEMICAL REDUCTION COULD BE IMPLEMENTED TO COMPLY WITH ARARS.

LONG-TERM EFFECTIVENESS AND PERFORMANCE -- NO ACTION WOULD NOT BE EFFECTIVE IN THE LONG TERM. LONG-TERM EFFECTIVENESS FOR IN-SITU TREATMENT IS UNCERTAIN, AS THIS TECHNOLOGY IS STILL IN EXPERIMENTAL PHASES. BOTH ELECTROCHEMICAL TREATMENT AND CHEMICAL REDUCTION WOULD PROVIDE LONG-TERM EFFECTIVENESS AND PERFORMANCE THROUGH EXTRACTION, REMOVAL, DESTRUCTION OF CONTAMINANTS, AND LONG-TERM CONTAINMENT OF RESIDUALS.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT -- NO ACTION WOULD NOT RESULT IN A REDUCTION IN TMV THROUGH TREATMENT. REDUCTION IN TMV WOULD OCCUR BY ANY OF THE OTHER THREE ALTERNATIVES: IN-SITU TREATMENT, ELECTROCHEMICAL TREATMENT, OR CHEMICAL REDUCTION.

SHORT-TERM EFFECTIVENESS -- ALL ACTION ALTERNATIVES COULD BE IMPLEMENTED TO BE PROTECTIVE OF WORKERS AND THE COMMUNITY DURING IMPLEMENTATION.

IMPLEMENTABILITY -- ALL ACTION ALTERNATIVES ARE IMPLEMENTABLE. HOWEVER, FOR IN-SITU TREATMENT, A PILOT TEST TO DEMONSTRATE APPLICABILITY TO SITE-SPECIFIC CONDITIONS AND EFFECTIVENESS OF REMEDY WILL BE REQUIRED BEFORE FULL-SCALE IMPLEMENTATION.

COST -- NO ACTION WOULD COST \$1.223 MILLION, PRIMARILY FOR GROUNDWATER MONITORING. IN-SITU TREATMENT WOULD BE THE LEAST EXPENSIVE OF ALL TREATMENT ALTERNATIVES (\$1.895 MILLION). ELECTROCHEMICAL TREATMENT WOULD COST \$1.997 MILLION. CHEMICAL REDUCTION WOULD BE THE MOST COSTLY ALTERNATIVE, \$2.934 MILLION (ALL COSTS REPORTED AS PRESENT WORTH).

STATE ACCEPTANCE -- NO ACTION WOULD NOT BE ACCEPTABLE TO THE STATE. IN-SITU TREATMENT WOULD NOT BE ACCEPTABLE UNTIL EFFECTIVENESS OF TECHNOLOGY IS PROVEN FOR THIS SITE. BOTH ELECTROCHEMICAL TREATMENT AND CHEMICAL REDUCTION WOULD BE ACCEPTABLE TO THE STATE.

COMMUNITY ACCEPTANCE -- NO ACTION WOULD NOT BE ACCEPTABLE TO THE COMMUNITY. IN- SITU TREATMENT WOULD NOT BE ACCEPTABLE UNTIL EFFECTIVENESS OF TECHNOLOGY IS PROVEN FOR THIS SITE. BOTH ELECTROCHEMICAL TREATMENT AND CHEMICAL REDUCTION WOULD BE ACCEPTABLE TO THE COMMUNITY.



## REMEDY SELECTION RATIONALE

EPA HAS SELECTED ELECTROCHEMICAL TREATMENT AS THE REMEDY FOR GROUNDWATER BECAUSE IT IS MORE PROTECTIVE AND EFFECTIVE THAN NO ACTION OR IN-SITU TREATMENT AND AS PROTECTIVE AND EFFECTIVE AS CHEMICAL REDUCTION. HOWEVER, ELECTROCHEMICAL TREATMENT IS LESS COSTLY THAN CHEMICAL REDUCTION.

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### 9.0 SELECTED REMEDIES

THE FOLLOWING TEXT PRESENTS THE SELECTED REMEDIES FOR CONTAMINATED SOIL AND GROUNDWATER. BOTH REMEDIES WILL BE PERFORMED TO ADDRESS EITHER 1 X (10<sup>-6</sup>) OR GREATER CANCER RISK LEVEL, GREATER THAN A HAZARD INDEX OF 1 FOR NONCARCINOGENIC RISKS OR BACKGROUND (NONDETECT) LEVELS WHERE ACHIEVABLE.

#### 9.1 REMEDY FOR CONTAMINATED SOILS

##### REMEDY DESCRIPTION

FOR CONTAMINATED SOILS, EPA PLANS TO EXCAVATE THE SOIL, FIX IT WITH A CEMENT-BASED COMPOUND, AND MAINTAIN THE MIXTURE ON-SITE TO PREVENT FUTURE EXPOSURE OR MOVEMENT. FOR THIS REMEDY TO BE IMPLEMENTED, SURFACE SOIL (0 TO 4 FEET) CONTAINING HEXAVALENT CHROMIUM AND ARSENIC AT 4 PPM AND 2 PPM, RESPECTIVELY, MUST BE EXCAVATED AND FIXED. SUBSURFACE SOIL (4 FEET TO GROUNDWATER) WITH LEACHATE CONCENTRATIONS ABOVE 5 PPB FOR CHROMIUM AND ARSENIC, RESPECTIVELY, WOULD ALSO BE EXCAVATED AND FIXED. FIXED SOIL EXCEEDING CCR TITLE 22 TTLC/STLC AND TITLE 23, CHAPTER 15 CRITERIA WOULD BE PLACED IN LINED CELLS. FIXED SOIL MEETING TTLC/STLC AND TITLE 23 CRITERIA WOULD BE PLACED BACK ONTO THE SITE.

EXCAVATION WILL BE PERFORMED USING CONVENTIONAL EARTHMOVING EQUIPMENT. THE EXCAVATED SOIL WILL BE BLENDED WITH COMMERCIALLY AVAILABLE CHEMICAL STABILIZING AGENTS (SUCH AS PORTLAND CEMENT) IN MIXING EQUIPMENT SIMILAR TO A CONCRETE BATCHING PLANT. THE AGENTS AND THE MIX RATIO WILL BE BASED ON TREATABILITY STUDIES PERFORMED USING SITE SOILS. THE FIXED-SOIL MATRIX WILL BE USED TO BACKFILL THE EXCAVATION. A LINER BELOW THE FIXED SOIL WOULD BE REQUIRED FOR SOILS CONTAINING ARSENIC GREATER THAN 500 PPM, CHROMIUM GREATER THAN 500 PPM, AND COPPER GREATER THAN 2,500 PPM (CALIFORNIA TITLE 22 TTLC CRITERIA). A LINER WOULD ALSO BE REQUIRED IF LEACHABLE ARSENIC AND CHROMIUM EXCEED 5 PPM AND COPPER 25 PPM (CALIFORNIA TITLE 22 STLC CRITERIA). COLLECTION, HANDLING, AND DISPOSAL OF LEACHATE AND LONG-TERM MONITORING ARE REQUIRED TO COMPLY WITH STATE AND FEDERAL REGULATIONS. DEED RESTRICTIONS ARE REQUIRED FOR ALL AREAS WHERE TREATED WASTE HAS BEEN DEPOSITED.

IT IS ESTIMATED THAT APPROXIMATELY 15,000 CUBIC YARDS OF CONTAMINATED SOIL WILL BE FIXED WITH THIS REMEDY. REMEDIAL OBJECTIVES ARE ESTIMATED TO BE ACHIEVED IN APPROXIMATELY 9 MONTHS, IF REMEDIAL ACTIONS ARE DONE CONTINUOUSLY. CAPITAL AND PRESENT-WORTH COSTS HAVE BEEN ESTIMATED AT \$1,853,000 (JANUARY 1991 DOLLARS; SEE PAGES 7-1 AND 7-4). ANNUAL OPERATION AND MAINTENANCE COSTS, PRIMARILY FOR GROUNDWATER MONITORING FOR THE ENTIRE ON-SITE AND OFF-SITE AREAS NOT DIRECTLY RELATED WITH FIXATION, ARE INCLUDED IN THE REMEDY FOR CONTAMINATED GROUNDWATER (SECTION 9.2).

##### REMEDY SELECTION RATIONALE

THE SELECTED REMEDY SATISFIES THE TWO THRESHOLD CRITERIA (OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT AND COMPLIANCE WITH ARARS), PROVIDES THE BEST BALANCE OF THE FIVE BALANCING CRITERIA (LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION IN TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT; SHORT-TERM EFFECTIVENESS; IMPLEMENTABILITY; AND COST). THIS ALTERNATIVE USES PERMANENT SOLUTIONS AND AN ALTERNATIVE TECHNOLOGY OR RESOURCE RECOVERY TO THE MAXIMUM EXTENT PRACTICABLE. THIS ALTERNATIVE, COMPARED WITH THE OTHER REMEDIAL ALTERNATIVES, PROVIDES THE MOST OVERALL PROTECTION, MOST FULLY COMPLIES WITH ARARS, AND HAS THE BEST LONG-TERM EFFECTIVENESS. IT ALSO PERMANENTLY REDUCES THE MOBILITY OF THE CONTAMINANT. EVEN THOUGH THIS ALTERNATIVE IS ASSOCIATED WITH THE HIGHEST COST, IT IS COST-EFFECTIVE, AS IT PROVIDES THE HIGHEST LEVEL OF EFFECTIVENESS FOR A REASONABLE COST. THE SELECTED REMEDY ALSO HAS THE STRONGEST STATE AND COMMUNITY ACCEPTANCE.

THE OBJECTIVES OF THE REMEDY FOR CONTAMINATED SOILS ARE TO PREVENT SURFACE-WATER RUNOFF OF CONTAMINATED SURFACE SOILS, TO PREVENT AIR EMISSIONS OF CONTAMINATED DUSTS, AND TO PREVENT

CONTAMINANTS FROM LEACHING INTO THE GROUNDWATER, WHICH IS A DRINKING WATER AQUIFER AT THIS SITE. BASED ON INFORMATION OBTAINED DURING THE REMEDIAL INVESTIGATION AND ON A CAREFUL ANALYSIS OF ALL REMEDIAL ALTERNATIVES, EPA AND THE STATE OF CALIFORNIA BELIEVE THAT THE SELECTED REMEDY WILL ACHIEVE THESE GOALS THROUGH PROPER IMPLEMENTATION AND MONITORING OF THE ACTION. THE SELECTED SOIL REMEDY WILL BE COUPLED WITH GROUNDWATER EXTRACTION AND TREATMENT. THE REMOVAL AND TREATMENT OF CONTAMINATED SOILS MAY SIGNIFICANTLY REDUCE THE TIME REQUIRED FOR EXTRACTION AND TREATMENT OF GROUNDWATER CONTAMINATED WITH INORGANIC COMPOUNDS. THE POINT OF COMPLIANCE WILL BE ALL SITE SOILS FROM THE SURFACE TO THE WATER TABLE THAT CONTAIN CONTAMINATION ABOVE THE CLEANUP STANDARDS.

PERIODIC GROUNDWATER, SURFACE WATER RUNOFF, AND AIR QUALITY MONITORING AND SAMPLING OF LEACHATE WILL BE REQUIRED TO DETERMINE THE EFFECTIVENESS OF THIS REMEDY AND TO VERIFY ACHIEVEMENT OF CLEANUP LEVELS. LONG-TERM OPERATION AND MAINTENANCE (O&M) ACTIVITIES FOR THE TREATED SOIL MASS, INSTITUTIONAL AND ENGINEERING CONTROLS, AND THEIR COST ESTIMATES WILL ALSO BE REQUIRED FOR A PERIOD OF 30 YEARS. SUCH REQUIREMENTS AND A SPECIFIC MONITORING PROGRAM WILL BE DEFINED MORE PRECISELY DURING THE REMEDIAL DESIGN/REMEDIAL ACTION (RD/RA) PHASE.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT WAS THE MOST IMPORTANT CRITERION IN SELECTING THE SOIL REMEDY. THE SELECTED REMEDY WAS THE ONLY ALTERNATIVE WHICH SATISFIED THIS THRESHOLD CRITERION.

#### ARARS

THE SELECTED REMEDY WILL COMPLY WITH ARARS. HEALTH-BASED ARARS PERTAINING TO SOIL CONTAMINATED WITH INORGANIC COMPOUNDS ARE NOT AVAILABLE FOR THE SITE. THE SOIL CONTAMINATION WILL THEREFORE BE REDUCED TO THE HEALTH-BASED STANDARDS DISCUSSED IN SECTION 4.0 THAT ELIMINATE THREATS TO PUBLIC HEALTH AND THE ENVIRONMENT THROUGH SURFACE WATER, GROUNDWATER, AND AIR.

SURFACE SOIL (0 TO 4 FEET) WILL BE EXCAVATED TO 1 X (10<sup>-6</sup>) EXCESS CANCER RISK LEVEL (4 PPM FOR HEXAVALENT CHROMIUM AND 2 PPM FOR ARSENIC). SUBSURFACE SOIL (FROM 4 FEET BELOW SURFACE TO GROUNDWATER) WILL BE EXCAVATED TO LEVELS THAT WILL MEET CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD DESIGNATED LEVEL METHODOLOGY LEACHABILITY LIMITS (5 PPB FOR CHROMIUM AND ARSENIC). THE SOILS WILL BE TREATED TO REDUCE LEACHABILITY TO LEVELS THAT REMAIN PROTECTIVE OF THE GROUNDWATER RESOURCE.

TREATED SOILS WILL BE PLACED AS NECESSARY IN TREATMENT CELLS DESIGNED TO MEET FEDERAL AND STATE LAND DISPOSAL REQUIREMENTS. THE TREATMENT TECHNOLOGY USED WILL REDUCE LEACHABILITY OF CONTAMINANTS TO BELOW THE RCRA LAND DISPOSAL REQUIREMENTS. ONCE TREATED, THE SOIL WILL NO LONGER BE A HAZARDOUS WASTE AS LONG AS LEACHABILITY OF THE FIXED SOIL MEETS THE TREATMENT STANDARDS.

## 9.2 REMEDY FOR CONTAMINATED GROUNDWATER

#### REMEDY DESCRIPTION

FOR CONTAMINATED GROUNDWATER, EPA HAS SELECTED THE REMEDY INVOLVING EXTRACTION, ELECTROCHEMICAL TREATMENT, ACTIVATED ALUMINA ADSORPTION, AND DISCHARGE. GROUNDWATER WILL BE TREATED TO ACHIEVE EPA CLEANUP STANDARDS BEFORE REUSE OR DISCHARGE FROM THE SITE. EPA PLANS TO USE AN ELECTROCHEMICAL TREATMENT PROCESS, SIMILAR TO THAT CURRENTLY USED AT THE SITE FOR GROUNDWATER TREATMENT TO REMOVE DISSOLVED HEXAVALENT CHROMIUM FOLLOWED BY ACTIVATED ALUMINA ADSORPTION TO REMOVE RESIDUAL DISSOLVED ARSENIC.

EXTRACTED GROUNDWATER WOULD BE TRANSFERRED TO A HOLDING TANK. FERROUS IONS FROM THE FERROUS ION GENERATOR WOULD BE INJECTED CONTINUOUSLY INTO THE WATER TRANSFER PIPING WHERE MIXING WOULD OCCUR. THE REDUCTION OF HEXAVALENT CHROMIUM TO ITS TRIVALENT FORM WOULD OCCUR IN THE PIPING AND IN THE HOLDING TANK. THE REDUCED CHROMIUM WOULD PRECIPITATE OUT IN THE HOLDING TANK. THE EFFLUENT FROM THE ELECTROCHEMICAL TREATMENT PROCESS WOULD THEN BE TRANSFERRED TO AN ALUMINA-ADSORPTION COLUMN FOR SECONDARY TREATMENT TO REMOVE RESIDUAL ARSENIC.

GROUNDWATER TREATED TO HEALTH-BASED STANDARDS WILL BE DISPOSED OF THROUGH ONE OR BOTH OF THE FOLLOWING MEANS: (1) INFILTRATION AND EVAPORATION AT ONE OR MORE PERCOLATION PONDS, AND (2) UNDERGROUND INJECTION THROUGH SUBSURFACE INJECTION WELLS. THE TREATMENT PROCESS WILL GENERATE SLUDGE CONTAINING ELEVATED METAL CONCENTRATIONS THAT WILL BE DISPOSED OF AT AN OFF-SITE WASTE

DISPOSAL FACILITY IN ACCORDANCE WITH STATE AND FEDERAL REGULATIONS. DISPOSAL DETAILS WILL BE DEFINED FURTHER DURING THE RD PHASE, AND EPA WILL WORK CLOSELY WITH ALL APPROPRIATE STATE AND LOCAL AGENCIES ON THIS ISSUE BEFORE DISPOSAL IS CARRIED OUT DURING RA.

THIS GROUNDWATER ALTERNATIVE WILL REDUCE CONTAMINANTS TO THE CLEANUP STANDARDS LISTED IN TABLE 4-1. CHROMIUM IN GROUNDWATER WILL BE CLEANED UP TO 50 PPB, WHICH IS THE CALIFORNIA MCL, AND ARSENIC IN GROUNDWATER WILL BE CLEANED UP TO 16 PPB, CORRESPONDING TO A HAZARD INDEX OF LESS THAN 1. BOTH OF THESE CONCENTRATION LEVELS CORRESPOND TO THOSE THAT WILL REDUCE THE HAZARD INDEX TO LESS THAN 1. POINT OF COMPLIANCE FOR THE REMEDY WILL BE THE ENTIRE AQUIFER BELOW THE SITE AND DOWNGRADIENT, AS DEFINED BY THE ARSENIC AND CHROMIUM PLUMES. CONTINUED DEFINITION OF THE PLUME EXTENT AND COMPLIANCE WITH THE GROUNDWATER STANDARDS WILL BE DEMONSTRATED THROUGH A NETWORK OF MONITORING WELLS. THE REMEDY WILL TREAT ALL CONTAMINANTS TO THEIR TREATMENT STANDARDS.

GROUNDWATER EXTRACTION AND TREATMENT IS ESTIMATED TO BE AT A RATE OF APPROXIMATELY 250 GALLONS PER MINUTE, CORRESPONDING TO ABOUT 360,000 GALLONS PER DAY. IT IS UNCERTAIN HOW LONG IT WILL TAKE TO ACHIEVE THE REMEDIAL OBJECTIVES; HOWEVER, IS ESTIMATED TO TAKE AT LEAST 5 YEARS. CAPITAL COSTS HAVE BEEN APPROXIMATED AT \$177,000. ANNUAL OPERATION AND MAINTENANCE COSTS ARE ESTIMATED AT \$224,000 (\$147,000 FOR REMEDIATION AND \$77,000 FOR GROUNDWATER MONITORING). THE PRESENT WORTH OF THIS REMEDY IS ESTIMATED AT \$1,997,000, BASED ON A DISCOUNT RATE OF 5 PERCENT AND PERIOD OF OPERATION OF 5 YEARS AND GROUNDWATER MONITORING FOR 30 YEARS. ALL COSTS REPORTED ARE IN JANUARY 1991 DOLLARS.

AT THE TIME OF DEVELOPMENT OF THIS ROD, THE EXISTING GROUNDWATER TREATMENT PLANT DOES NOT HAVE THE ACTIVATED ALUMINA-ADSORPTION COLUMN, HAS NOT RUN IN A CONTINUOUS MODE, HAS NOT BEEN TESTED AT DESIGN CAPACITY, AND THE EFFECTIVENESS OF THE FACILITY IN REMOVAL OF METALS HAS NOT BEEN FULLY DEMONSTRATED. EPA WILL ALLOW ONE YEAR FROM INITIATION OF REMEDIAL DESIGN TO MODIFY THE FACILITY AND TREATMENT SCHEME TO ACHIEVE THE STANDARDS PRESENTED IN TABLE 4-1. FACILITY PERFORMANCE REQUIREMENTS WILL BE SPECIFIED IN THE SCOPE OF WORK.

#### REMEDY SELECTION RATIONALE

THE SELECTED REMEDY PROVIDES THE BEST BALANCE OF THE TWO THRESHOLD CRITERIA AND THE FIVE BALANCING CRITERIA. THIS ALTERNATIVE USES PERMANENT SOLUTIONS AND ALTERNATIVE TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. THE IN-SITU CHEMICAL TREATMENT ALTERNATIVE IS NOT CONSIDERED TO BE FULLY PROTECTIVE AND COMPLYING WITH GROUNDWATER ARARS BECAUSE OF THE UNCERTAINTY ASSOCIATED WITH ITS LONG-TERM EFFECTIVENESS. THE REMAINING TWO GROUNDWATER EXTRACTION AND TREATMENT ALTERNATIVES ARE VERY SIMILAR IN ALL EVALUATION CRITERIA, EXCEPT FOR COST. THE SELECTED REMEDY IS MORE COST-EFFECTIVE THAN THE ALTERNATIVE INVOLVING CHEMICAL REDUCTION. THE SELECTED ALTERNATIVE PROVIDES THE BEST LONG-TERM AND SHORT-TERM EFFECTIVENESS; PERMANENTLY AND SIGNIFICANTLY REDUCES THE TOXICITY, MOBILITY, AND VOLUME OF HAZARDOUS SUBSTANCES THROUGH TREATMENT; AND CAN BE IMPLEMENTED AT THE SITE AT SUBSTANTIALLY LOWER COST THAN THE TREATMENT ALTERNATIVE INVOLVING CHEMICAL REDUCTION/PRECIPITATION. THE SELECTED REMEDY EMPLOYS TREATMENT AS A PRINCIPAL ELEMENT THAT SIGNIFICANTLY AND PERMANENTLY REDUCES TOXICITY, MOBILITY, OR VOLUME OF THE HAZARDOUS SUBSTANCES. IT IS PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT, COMPLIES WITH FEDERAL AND STATE ARARS, AND IS COST-EFFECTIVE.

THE OBJECTIVE OF THIS REMEDIAL ALTERNATIVE IS TO RESTORE GROUNDWATER TO ITS BENEFICIAL USE, AS A DRINKING WATER SOURCE FOR THIS SITE AND VICINITY. BASED ON INFORMATION OBTAINED DURING THE REMEDIAL INVESTIGATION AND ON A CAREFUL ANALYSIS OF ALL REMEDIAL ALTERNATIVES, EPA AND THE STATE OF CALIFORNIA BELIEVE THAT THE STANDARDS REQUIRED BY THE SELECTED REMEDY WILL ACHIEVE THIS OBJECTIVE. THE SELECTED REMEDY WILL REQUIRE CONTAMINATED SOIL REMOVAL AND TREATMENT TO ACHIEVE THIS OBJECTIVE IN A TIMELY MANNER. THE SELECTED REMEDY IS EXPECTED TO TAKE AT LEAST 5 YEARS TO ACCOMPLISH. THE SYSTEM WILL BE ADJUSTED AS WARRANTED BY THE PERFORMANCE DATA COLLECTED DURING ITS OPERATION.

PERIODIC GROUNDWATER MONITORING WILL BE REQUIRED TO DETERMINE THE EFFECTIVENESS OF THE REMEDY AND TO VERIFY ACHIEVEMENT OF THE CLEANUP STANDARDS. LONG-TERM O&M ACTIVITIES, INSTITUTIONAL AND ENGINEERING CONTROLS, AND THEIR COSTS WILL BE REQUIRED. SUCH REQUIREMENTS AND A SPECIFIC MONITORING PROGRAM WILL BE DEFINED PRECISELY AS THE SCOPE OF WORK IS DEVELOPED.

#### ARARS

THIS ALTERNATIVE WILL COMPLY WITH FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.

THE GROUNDWATER REMEDIATION AND TREATMENT STANDARDS SELECTED FOR THE GROUNDWATER REMEDY ARE PRESENTED IN TABLE 4-1. THESE STANDARDS WERE SELECTED BY THE PROCESS DESCRIBED BELOW. IN ACCORDANCE WITH SECTION 300.430(E) OF THE NCP, FEDERAL MCLGS, WHERE PROMULGATED, WERE INITIALLY SELECTED AS THE TREATMENT STANDARDS. IN THE EVENT THAT THE MCLG HAS BEEN SET AT A LEVEL OF ZERO, THEN THE FEDERAL MCLS, WHERE PROMULGATED, OR THE  $1 \times (10^{-6})$  RISK OR HAZARD INDEX OF 1 WAS SELECTED. IN THE EVENT THAT A MORE STRINGENT MCL HAS BEEN PROMULGATED BY THE STATE OF CALIFORNIA, THEN THE STATE MCL WAS SELECTED AS THE TREATMENT STANDARD. THE SELECTED REMEDY WILL ACHIEVE THE TREATMENT STANDARD IN THE ENTIRE AQUIFER BELOW THE SITE AND VICINITY AND IN THE EFFLUENT DISCHARGED FROM THE TREATMENT UNIT.

FOR HEXAVALENT CHROMIUM, THE TREATMENT STANDARD OF 50 PPB REPRESENTS THE CALIFORNIA MCL. IT ALSO REPRESENTS THE LEVEL AT WHICH THE HAZARD INDEX IS REDUCED TO LESS THAN 1. FOR ARSENIC, THE TREATMENT STANDARD OF 16 PPB REPRESENTS THE LEVEL AT WHICH THE HAZARD INDEX IS REDUCED TO LESS THAN 1. THIS LEVEL WAS SELECTED INSTEAD OF THE MCL AS IT (16 PPB) IS MORE PROTECTIVE. THESE CONTAMINANTS WERE DETECTED IN GROUNDWATER AT LEVELS EXCEEDING THEIR TREATMENT STANDARDS.

THE TREATMENT TECHNOLOGY USED IN THE SELECTED REMEDY WILL TREAT CONTAMINATED GROUNDWATER TO NONHAZARDOUS WASTE LEVELS, AND THE GROUNDWATER WILL NO LONGER BE SUBJECT TO REGULATION UNDER SUBTITLE C OF RCRA.

### 9.3 CONCLUSION

BOTH REMEDIES IDENTIFIED IN THIS ROD WILL REDUCE THE RESIDUAL RISK FOR EACH CONTAMINANT IN SOIL AND GROUNDWATER AT THE SITE TO LESS THAN  $1 \times (10^{-6})$  RISK OR A HAZARD INDEX LESS THAN 1. THE REMEDIES, MENTIONED IN THE PRECEDING SECTIONS, MAY NEED TO BE MODIFIED AS A RESULT OF THE REMEDIAL DESIGN AND CONSTRUCTION PROCESS. THE CHANGES MAY REFLECT ALTERATIONS MADE DURING THE REMEDIAL DESIGN PHASE AND WILL BE PERFORMED SO THAT STANDARDS STATED IN TABLE 4-1 WILL BE MET AND THE REMEDIES WILL REMAIN PROTECTIVE AND EFFECTIVE.

#SD

### 10.0 STATUTORY DETERMINATIONS

THE SELECTED REMEDIES SATISFY THE TWO THRESHOLD CRITERIA AND PROVIDE THE BEST BALANCE OF THE FIVE BALANCING CRITERIA.

THE SELECTED REMEDIES ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AS REQUIRED BY SECTION 121 OF CERCLA. EXISTING OR POTENTIAL RISKS FROM EXPOSURE TO SOILS AND GROUNDWATER WILL BE ELIMINATED, REDUCED, AND CONTROLLED BY TREATING CONTAMINATION, STABILIZING CONTAMINATION, AND CONTAINING CONTAMINANTS. REMEDIAL OBJECTIVES WILL REDUCE EXCESS CANCER RISKS TO  $(10^{-6})$  WHEN POSSIBLE (IF BACKGROUND LEVELS OF CHEMICALS DO NOT EXCEED THIS RISK LEVEL), WHICH IS WITHIN THE  $(10^{-4})$  TO  $(10^{-6})$  RISK RANGE. RISKS FROM NONCARCINOGENS WILL BE REDUCED TO HAZARD INDICES OF LESS THAN ONE. ALL CONTAMINANTS OF CONCERN WILL BE ADDRESSED BY THE PROPOSED REMEDIES. DURING THE IMPLEMENTATION OF THE REMEDIES, ENGINEERING CONTROLS SUCH AS DUST CONTROL MEASURES WILL BE EMPLOYED TO ENSURE AGAINST UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS.

THE REMEDIES SELECTED WILL COMPLY WITH ARARS. THE REMEDIES SELECTED WILL MEET SAFE DRINKING WATER ACT MCLS AND THE CALIFORNIA DTSC APPLIED ACTION LEVELS FOR DRINKING WATER FOR CONTAMINANTS OF CONCERN.

THE REMEDIES FOR CONTAMINATED SOIL WILL COMPLY WITH FEDERAL AND STATE LAND DISPOSAL RESTRICTIONS. CONCENTRATIONS OF CONTAMINANTS WITHIN LEACHATE GENERATED FROM THE WASTE WILL BE HANDLED IN COMPLIANCE WITH 40 CFR 268 AND CCR TITLE 23, DIVISION 3, CHAPTER 15. THE TREATMENT TECHNOLOGY USED WILL REDUCE LEACHABILITY OF CONTAMINANTS TO BELOW THE RCRA LAND DISPOSAL REQUIREMENTS. ONCE TREATED, THE SOIL WILL NO LONGER BE A HAZARDOUS WASTE AS LONG AS LEACHABILITY OF THE FIXED SOIL MEETS THE TREATMENT STANDARDS.

THE REMEDY FOR GROUNDWATER WILL COMPLY WITH THE STATE'S WELL INSTALLATION REGULATIONS, WATER TREATMENT FACILITY SITING AND OPERATION REGULATIONS, AND WORKER PROTECTION REGULATIONS.

THE DISCHARGE OF TREATED EFFLUENT WILL COMPLY WITH ARARS AND TCBS, AS DESCRIBED MORE FULLY IN

## SECTION 9.0.

DURING IMPLEMENTATION OF THE REMEDIES, THE SUBSTANTIVE REQUIREMENTS OF THE STANISLAUS COUNTY AIR POLLUTION CONTROL DISTRICT WILL BE MET.

THE AFOREMENTIONED PROTECTIVENESS AND COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS WILL BE ACHIEVED COST EFFECTIVELY. THE ALTERNATIVES CHOSEN ARE THE COST-EFFECTIVE APPROACHES AVAILABLE TO ACHIEVE THE NECESSARY DEGREE OF PROTECTIVENESS.

THE SELECTED REMEDIES USE PERMANENT SOLUTIONS AND ALTERNATIVE TECHNOLOGIES TO THE MAXIMUM EXTENT POSSIBLE AND SATISFY THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY AS A PRINCIPAL ELEMENT TREATMENT THAT REDUCES TOXICITY, MOBILITY, OR VOLUME.

THE CLEANUP STANDARDS DEFINED IN THIS ROD ARE SUBJECT TO REEVALUATION WITH RESPECT TO EFFECTIVENESS IN PROTECTING HUMAN HEALTH AND THE ENVIRONMENT AT THE 5-YEAR REVIEW PERIOD.

### 10.1 CONTAMINATED SOILS

THE PROPOSED REMEDY, EXCAVATION, FIXATION AND ON-SITE DISPOSAL, WILL BE PROTECTIVE THROUGH CONTAINMENT OF THE METALS IN THE FIXED-SOIL MASS. THIS ALTERNATIVE WILL INVOLVE TREATMENT TO REDUCE MOBILITY. TOXICITY AND VOLUME WILL NOT BE REDUCED. SHORT-TERM EFFECTIVENESS WILL BE MAINTAINED THROUGH STRICT ENVIRONMENTAL CONTROLS. THE ALTERNATIVE IS IMPLEMENTABLE USING STANDARD EQUIPMENT AND MATERIALS.

THE NO ACTION ALTERNATIVE WOULD NOT BE PROTECTIVE BECAUSE CONTAMINANTS WOULD CONTINUE TO BE RELEASED INTO GROUNDWATER, SURFACE WATER RUNOFF, AND IN AIRBORNE DUST.

THE CAPPING ALTERNATIVE WOULD BE ONLY PARTIALLY PROTECTIVE OF GROUNDWATER. MOBILITY INTO GROUNDWATER WOULD REMAIN A CONCERN.

THE IN-SITU FLUSHING ALTERNATIVE MAY BE ONLY PARTIALLY PROTECTIVE OF GROUNDWATER, AS SITE CONDITIONS MAY LIMIT THE FEASIBILITY OF THIS ALTERNATIVE.

### 10.2 CONTAMINATED GROUNDWATER

THE GROUNDWATER REMEDY, EXTRACTION FOLLOWED BY ELECTROCHEMICAL TREATMENT AND ACTIVATED ALUMINA ADSORPTION, WILL BE A PERMANENT SOLUTION BECAUSE THE CONTAMINANTS WILL BE DESTROYED OR REMOVED FROM THE GROUNDWATER. THE GROUNDWATER REMEDY IS EXPECTED TO TAKE AT LEAST 5 YEARS TO ACHIEVE TREATMENT STANDARDS. SIGNIFICANT REDUCTION IN TMV WILL OCCUR. THE ALTERNATIVE IS IMPLEMENTABLE USING READILY AVAILABLE EQUIPMENT AND MATERIALS.

THE NO ACTION ALTERNATIVE WOULD NOT BE PROTECTIVE BECAUSE CONTAMINANTS WOULD CONTINUE TO REMAIN IN THE GROUNDWATER.

THE IN-SITU CHEMICAL TREATMENT ALTERNATIVE MAY BE ONLY PARTIALLY PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, AS INSUFFICIENT DATA EXIST TO DEMONSTRATE THE EFFECTIVENESS OF THIS TECHNOLOGY.

THE CHEMICAL REDUCTION/PRECIPITATION ALTERNATIVE OFFERS THE SAME TMV AND RISK REDUCTION BENEFITS AND EFFECTIVENESS AS THE SELECTED GROUNDWATER REMEDY. HOWEVER, IT IS MORE EXPENSIVE THAN THE SELECTED REMEDY, AND THEREFORE NOT AS COST-EFFECTIVE.

#DSC

#### 11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

SUBSURFACE SOIL CLEANUP STANDARDS FOR HEXAVALENT CHROMIUM AND ARSENIC AT THE SITE HAVE BEEN REVISED SINCE THE ISSUANCE OF THE PROPOSED PLAN. THE REVISED CLEANUP STANDARDS FOR EACH OF THESE TWO CHEMICALS ARE 5 PPB IN LEACHATE FOR SUBSURFACE SOILS (4 FEET TO GROUNDWATER). THESE STANDARDS ARE BASED ON RECOMMENDATIONS BY THE CALIFORNIA CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD (CRWQCB). ACCORDING TO THEIR RECOMMENDATIONS, THEIR JUNE 1989 UPDATED STAFF REPORT "THE DESIGNATED LEVEL METHODOLOGY FOR WASTE CLASSIFICATION AND CLEANUP LEVEL DETERMINATION" WAS USED TO CALCULATE THE SOLUBLE DESIGNATED LEVELS, THUS DETERMINING SOIL CLEANUP LEVELS ON THE LEACHABLE CONCENTRATIONS, ASSUMING AN ATTENUATION FACTOR OF 1, DUE TO THE PRESENCE OF HEXAVALENT CHROMIUM AND ARSENIC IN THE GROUNDWATER AND THE LIMITED ATTENUATION OF THE EXISTING ON-SITE CONTAMINATED SOILS. THUS THE REVISED CLEANUP STANDARDS OF 5 PPB OF HEXAVALENT CHROMIUM AND ARSENIC IN LEACHATE FOR SUBSURFACE SOILS ARE SOLUBLE DESIGNATED LEVEL METHODOLOGY CONCENTRATIONS, AND ARE BASED ON CRWQCB GUIDANCE ON WHETHER A WASTE POSES A THREAT TO BENEFICIAL USES OF THE GROUNDWATER.

TABLE 4-1

## CONTAMINANT CONCENTRATIONS AND CLEANUP STANDARDS

CONTAMINANT	BACKGROUND LEVELS	MAXIMUM SITE LEVELS	SITE CLEANUP STANDARDS
SURFACE SOILS	(PPM)	(PPM)	(PPM)
HEXAVALENT CHROMIUM	LT 1	30	4A
ARSENIC	LT 3	140	2A
SUBSURFACE SOILS			LEACHATE (PPB)
HEXAVALENT CHROMIUM	LT 1	68	5 (DLM)B
ARSENIC	LT 3	232	5 (DLM)B
GROUNDWATER	(PPB)	(PPB)	TREATED WATER DISCHARGE LIMITS (PPB)
HEXAVALENT CHROMIUM	LT 10	28,000	50
		(STATE MCL)	
ARSENIC	LT 14	2,350	16
		(HI-C = 1)	

A STANDARD REPRESENTS A  $1 \times 10^{-6}$  EXCESS RISK CONCENTRATION.

B DLM: DESIGNATED LEVEL METHODOLOGY ADOPTED BY THE CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD (CVRWQCB) FOR PROTECTION OF GROUNDWATER

C HI LT=1: AN HI LT=1 MEANS THAT NO ADVERSE HEALTH EFFECT WOULD BE PRESENT DUE TO EXPOSURE TO THESE CONCENTRATIONS.